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Electrical World

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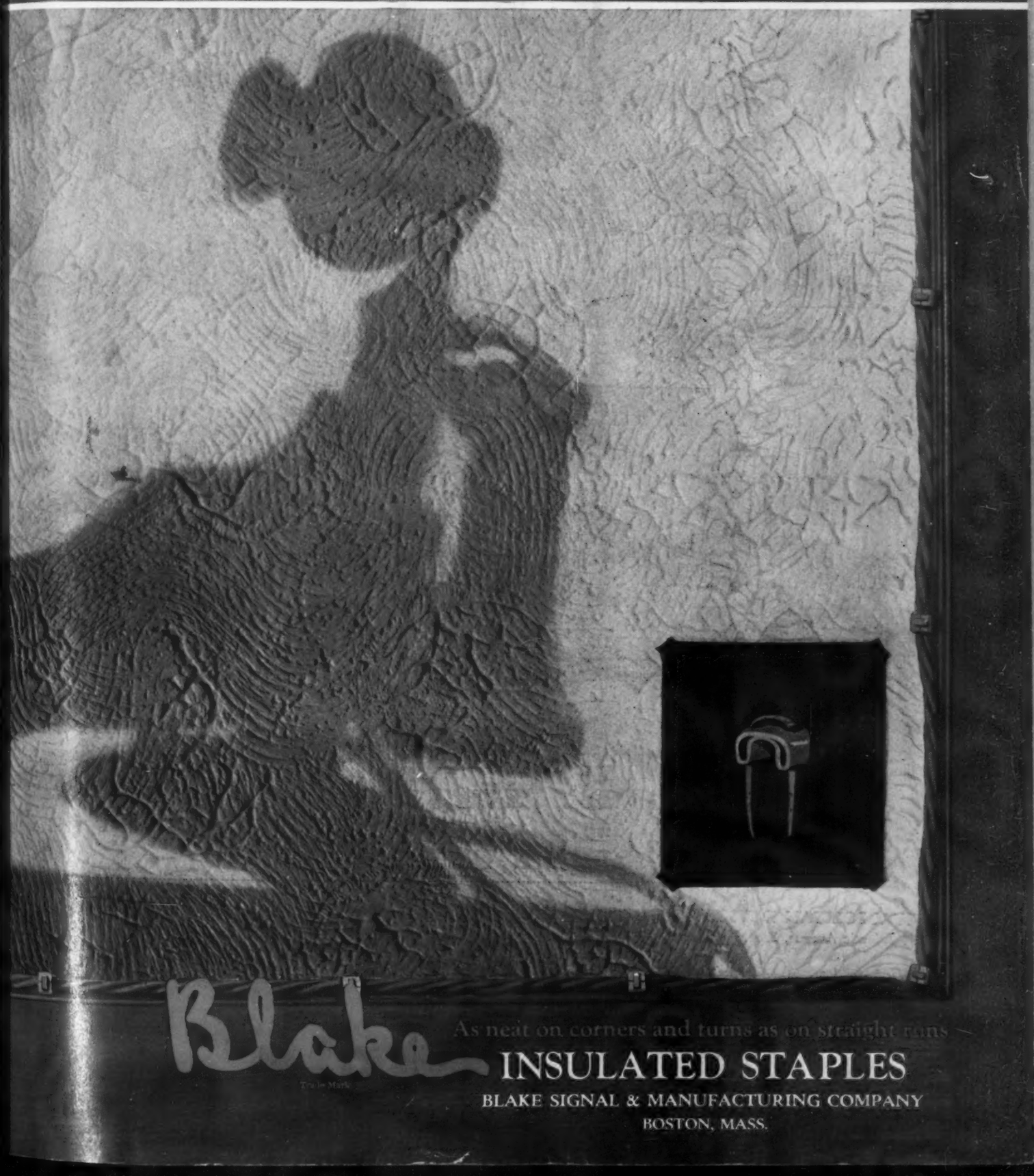

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Electrical World

The Consolidation of Electrical World, Electrical Engineer and American Electrician

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An Example of Competency

IN THIS ISSUE is published a complete report of the winter convention of the American Institute of Electrical Engineers. This report has news value, but its chief merit lies in the fact that it is an interpretation and digest of a very large group of technical papers and discussions. A skilled staff of editors has selected those things of value to the industry and has made clear the meaning of the papers and discussions. The editors are technically competent or they would not attempt to do more than give a verbatim news report of the meeting.

Editors who know intimately the men and the problems of the electrical industry understand the background upon which a technical Institute program is based. They can orient the papers and discussions in a way to focus them for the consideration of all groups in the industry. It is no easy task to sit in meetings at which technical papers and discussions are presented and then to treat with editorial liberty the happenings for publication. It is not a job for amateurs.

Confidence in the integrity and technical competency of ELECTRICAL WORLD editors is granted by the industry. Few readers who look over this report of the Institute meeting measure the work or talents of the editorial staff which makes the report possible. The editors also take such a report for granted as part of their job. They present this issue as a sample of the day-to-day competent service they render their readers.

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Electrical World

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W. H. ONKEN, JR.
Editor

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Impressions of the A.I.E.E. Convention

THERE is good reason for the electrical industry to be proud of its engineers. It has realized that engineering developments very accurately measure industry progress. The institute has grown to be a body of 20,000, and the winter convention in New York last week brought more than 1,400 engineers together to discuss engineering topics. It was a meeting which afforded an opportunity to survey developments in the art and to comprehend the policy elements related to industry progress.

Standardization policy and practices were discussed, and a very forceful address by President C. C. Chesney advocated a policy on electrical standardization which will create much discussion. In his opinion, all standards for the electrical industry should come under the jurisdiction of the institute. Standards may be initiated and made by any committee or by any group in the industry, but before they are finally accepted they should pass through a representative and judicial committee of the institute. This body represents all interests and is professional, competent and non-partisan in its consideration of matters brought before it. It alone, in the president's opinion, can pass upon standards from the standpoint of industry requirements.

This new policy will not be accepted without debate, nor will it be initiated without encountering many difficulties in formulating an acceptable procedure. All groups will not accept institute jurisdiction; several groups will ask for official recognition and representation; instructed delegations cannot be reconciled with an institute which is made up of individual professional members—these and many similar considerations will require notice. But, in the opinion of Mr. Chesney, the situation should be faced frankly and courageously. The institute cannot stand still, but must go forward if it is to serve industry needs in standardization.

NOMINAL ratings for equipments and the fact that generators, lines, transformers and utilization devices are rated with no allowance for voltage drop suggested the possibility of standardizing from generators to utilization devices on a drop basis or descending-voltage basis instead of on a flat-voltage basis. A group of papers on this subject were presented and discussed vigorously. No other conclusion could be reached by a listener than that the advisability of this procedure is very questionable from an economic standpoint at this time. More would be lost than gained because of the existing installations and the wide differences in systems as regards voltages, regulation, distances and service standards. A suggestion that maximum voltage at maximum load affords a definite rating as compared with the present nominal ratings and other suggestions of like character are well worthy of further consideration, and the meeting afforded a splendid clearing house for facts and opinions pertinent to further progress in uniformity.

New developments in equipments were not very marked in the machinery papers presented. The use of increased excitation on synchronous machines to improve the stability of operation under transient conditions was agreed to be valuable and practical. Papers on the theory of magnetization and magnetic actions under different conditions served to advance this side of the art. Dielectrics and cables served again as subjects for an important group of papers. More knowledge of magnetism and dielectric phenomena is needed by the industry. Industry developments in machines and in cables are retarded because of the semi-empirical approach now necessary to the design and use of this class of equipment. Measured by the gage of knowledge, very little actual progress has been made in proving several theories of magnetic and dielectric phenomena. It is necessary to delve into atomic structure of matter and to deal with electronic electrical phenomena, and progress is slow in these complicated realms of science.

VERY encouraging progress in the measurement of lightning surges was recorded. Data are not yet conclusive, but are sufficiently definite to give quantitative measures of lightning surges, including their magnitudes, their attenuation, their frequency of occurrence and the hazards they introduce. The klydonograph and the Dufour oscillograph are being worked overtime in a more intensive manner to prove the conclusions correct. The next step is to outline the technical methods for making service interruptions from surges an impossibility and the computation of the costs of doing this.

Mastery of lightning is at hand, and an epoch-making accomplishment in bettering electrical service has been achieved by engineers.

Papers dealing with communication advances, oil-breaker tests, and other important engineering topics were good and discussed fully. No one could attend the meetings without gaining information and without realizing that major engineering problems still handicap the progress of the industry. But along with an idea of problems to be solved the confidence of the engineers that they can solve them and the enthusiasm of the attacks made themselves felt. Engineers and engineering, measured by this meeting, are active and progressive.

Denver Utility Company's New Franchise Amicably Accepted

A NEW twenty-year franchise was granted by the city of Denver to the Public Service Company of Colorado last week. Being a home-rule city, Denver establishes rates for public utility service. The previous franchise of the company expired on May 15, 1926, but prior to that time an effort was made by the Public Service Company of Colorado to secure a renewal of the franchise, modified somewhat by new service conditions and rate schedules. That proposal was voted down by a large majority. Last March the city authorities engaged Ray Palmer to make a valuation of the property and to report upon fair and reasonable rates. After many conferences a new franchise was drafted embodying new gas and electric service conditions and a revised schedule of rates. This provides reductions for domestic electric consumers ranging from 12½ per cent to 35 per cent, with no possibility of rate increase except by the vote of the people. The Public Service Company of Colorado pays an annual franchise tax of $60,000 and obligates itself to purchase any hydro-electric power generated in connection with the municipal water-supply system.

While the rate reductions are predicated upon the allowance of an 8 per cent return on the engineer's valuation and aggregate approximately $672,000 a year, it is significant that Mr. Palmer allowed 10 per cent for going-concern value and approximately 5 per cent for working capital. All things considered, the new franchise is an excellent compromise, satisfactory to the city and the operating company and acceptable to the citizens of Denver. It marks an attempt to deal squarely with the public service corporation while at the same time safeguarding the interests of the public. The Public Service Company of Colorado showed commendable wisdom in acquiescing in the terms of the franchise rather than resorting to litigation and thus putting a stop to all controversy. Although the rate reductions seem somewhat drastic, there is no doubt that in time the rates will prove profitable, especially as the company has accepted the situation in such a fine sportsmanlike spirit.

Massachusetts Utility Companies and the Governor

COMMENDABLE indeed is the attitude of representative light and power companies in Massachusetts in response to Governor Fuller's "crusade" for lower rates. In the face of such attacks by men high in political life, a public utility runs no little risk of being misunderstood by the people if it reduces its prices for service when under executive fire. The easy inference of the man in the street is that the company has been driven to cover, and some managers are strongly opposed to making rate concessions under stress of this sort. Real courage, therefore, is required to go on with predetermined rate reductions in front of a barrage of gubernatorial verbal explosives, and no better example of keeping faith with the public could be cited.

Commendable also are those companies which cannot be stampeded into rate reductions until their equity is clear. The Governor of Massachusetts must realize that rate reductions are problems for the attention of specialists, for he is a business man as well as a politician. Some persons have wondered why Governor Fuller's statements have not brought forth full-page rebuttals in the daily press, signed statements from managers and presidents or "comebacks" broadcasted on the radio. Thus far, in the judgment of wise and experienced managements, such remedies have not been necessary.

In due time each company whose rates are attacked will have its "day in court" before the commission, and in every instance where it needs to be proved that reductions are in order the issue will be dispassionately determined. The Massachusetts commission's habit of paying strict attention to business amid the storms and stresses of political tides is now standing it in good stead. Successful regulation demands precisely such aloofness from controversy.

If there are any companies in Massachusetts which might properly have reduced their rates before but failed to do so until the Governor opened fire, we cannot name them. There may be some such, but if managerial mistakes and delays have occurred, the causes are not few. The intensely rapid growth of the industry, the swift replacement of old by new equipment and lack of data on the cost of different classes of service are some of the reasons why progress in rate reduction sometimes lags. For nearly half a century, also, surplus earnings have been going into plant in many Massachusetts companies.

But the real lesson in Massachusetts is the value of finding out what is just and fair by orderly methods of procedure, and this means standing by the constitutional rights of stockholders no less than striving to render the public the best possible service.

The Trouble with the Electrical Contractor-Dealer

THE Commercial Section, N.E.L.A., has just appointed a sub-committee on "trade relations." It is a good sign. The fact that this subject has been listed as a major problem by the power-company sales manager is the first tangible recognition of this issue that has cried so long for attention in the relations between the central station and the local trade in many communities. It is an initial step forward toward a policy that gradually will win for trade relations the same sort of careful and intelligent executive direction that has scotched the old spirit of "public be damned" and built out of it the present enlightened attitude of all progressive utility companies toward public relations. It will one day squelch the lingering "trade-be-damned" idea with equal effectiveness.

Frankly, what is the trouble with this electrical contractor-dealer, who, after all, is very little different from the average mechanic of any other trade—the plumber, the mason, the carpenter? Joseph A. Fowler, president of the Association of Electragists, in a recent address had this to say about it: "His individual thinking is pretty much the same as that of other electrical men. It is his group thinking that is different. Here are between thirty and forty thousand contractor-dealers, many of them self-promoted from the pliers and

lacking the commercial experience, the economic education, that any man needs to be successful in an independent enterprise. Engaged in a business in which his interests are closely tied in with the policies and activities of the power company, nevertheless he goes ahead 'lone wolf,' and there is no one at hand willing to tell him what he ought to do and show him how."

The responsibility is their own, Mr. Fowler admits, but the problem is too complex for the electragists to solve unaided. Realizing this, their association is working to enlist the interest and co-operation of the other groups. Meanwhile they are energetically conducting what amounts to an industry school in the field, trying to carry to the contractor a background of national thought and practice and to develop in him a national consciousness that will show him his relation to the rest of the industry and fit him into the local unity of purpose. It is a long job of education, yet it offers the contractor-dealer his best hope for economic health.

But many power companies have also worked "lone wolf." They have habitually established local policies vitally affecting the contractor or dealer with no real study of his problems or his interests. And in the past there has been no national effort to find the answer to the troubles between the central station and the contractor and establish principles to guide the local company. The present movement should have the support of every power executive both nationally and for application in his own town.

Wired Homes of the World

WE HAVE justly developed the habit of thinking of the United States as leading the world electrically, but by no means are we ahead in every respect. It is true that our progress and prosperity are due in a measure to our large consumption of electrical energy per worker—greater perhaps than in any other country. Our yearly consumption of lamps—more than three per capita—has also in the last fifteen years outstripped that of every other country, Germany coming second, Japan (with about half the increase) third, then Sweden and the Netherlands, with other nations far behind. In this country incandescent lamps to about one-half the total list value of all those sold each year are now being consumed in the homes.

None the less, it is instructive to compare the number of homes now wired in this country—about 58 per cent—with figures for other countries. According to latest reports, Switzerland may boast of wired homes aggregating about 96 per cent of the total number; Japan, 73 per cent; Denmark, 72 per cent; Canada, 62 per cent; New Zealand, 59 per cent, and the Netherlands, 50 per cent. At first glimpse these figures are startling, but when considered in connection with lamp consumption we see how much further we have advanced in the consumption of electricity per home. Accurate statistics are not available for appliances, but inasmuch as lighting constitutes the overwhelming use of electricity in the home at present, a fair perspective of the condition is obtained. Apparently, the United States ranks sixth in the percentage of homes wired, but ours is a very extensive country, so that the record is not so bad. A large percentage of our unwired homes are within reach of central-station service. If these were wired, we should still be outranked by Switzerland and should be in the class of Japan and Denmark.

The Duty of Sales Expansion

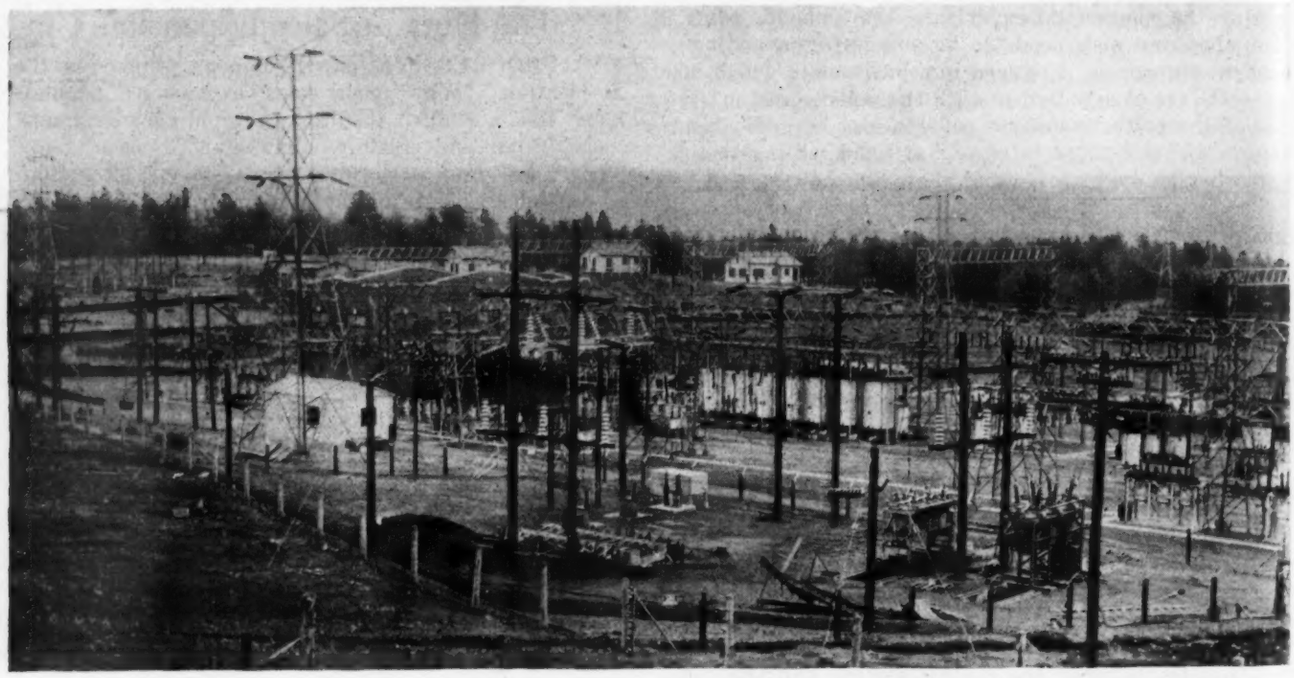
TO PROGRESSIVE power-company employees the question, "Why push sales expansion?" sounds almost like a studied insult. An intelligent grammar school child will readily answer, "To earn more money," but that is not the whole story. At bottom lies an industry duty of the first order, and this is the reason why lingering executive skepticism should give way to vigorous indorsement of all healthy means of load building. Statistics show even better than our senses that a wonderfully fine job has been done in building up the light and power industry from small beginnings to its present colossal magnitude. Look again at the Jan. 1 issue of the ELECTRICAL WORLD, *en passant*, but after all this development is but a fraction of the market attainable within a reasonable period. Now there are quite a number of executives who head companies that are highly prosperous but which are also commercially sluggish. Their prosperity exists in spite of their sales conservatism and not as a result of it. A very interesting economic phenomenon!

Electrical utilities are *public service* companies. Because of this the industry is impelled to extend its facilities into and through every practicable market. Maximum service at minimum over-all cost is its duty. It is not a matter of seeking greater dividends upon capital and effort. It is, rather, the problem of multiplying the use of electricity until the service saturation point is reached, and along with this must go the discovery and application of new and improved uses in volumes beyond present imagining. To seek lesser ends is to display indifference to the welfare of civilization.

The Need for Bank Examiners

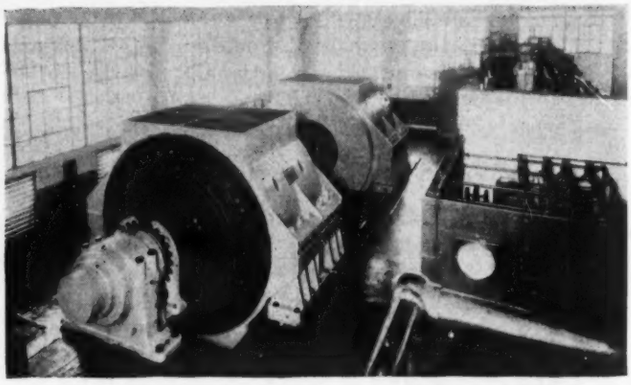
THE banking of transformers into secondary networks is a fine idea—if a watchful eye is kept on it. The economies inherent in the use of large-size units and in the reduction of the number of units effect a considerable decrease in transformer investment. The service reliability factor is improved and the advantages of load diversity are gained. But you can't connect many transformers into a secondary bank, say "That's that," and forget them.

As an instance of this good idea gone wrong a case may be cited of a city, approaching metropolitan size for its part of the country, in which the electrical utility was only a short time ago taken over by a central operating company. The engineers of the new organization descended upon the city and began to look over the new member of the family. The secondary voltage in the downtown area was lower than the load on the connected transformer capacity indicated it should be. The search for the reason was not long. A simple inspection revealed that 500 kva. in transformer capacity was standing around with its hands in its pockets, and the rest of the bank was carrying the load. In the course of years, while nobody was paying any attention, a number of primary fuses had popped out, one after the other. The general decrease in voltage had been by small bites, and the customers, if any of them noticed the condition, probably thought that the reduced visibility in their stores and offices was an indication of age creeping on apace with its attendant infirmity of failing eyesight.



Field and Laboratory Tests Afford Basis for Circuit-Breaker Development

MANUFACTURERS have provided large-scale laboratory facilities for testing circuit breakers under load conditions to ascertain the feasibility or effect of improvements, modifications or new developments. For some time electric service utilities which have sufficient capacity to test circuit breakers under conditions more nearly comparable with their short-circuit duty have been co-operating with manufacturers in field tests. Through co-ordination of these two forms of investigation, and with a broad-gaged program, proper sharing of expenses by all benefited and analyses of the results obtained, it can be expected that the desired development of circuit breakers will be brought about most promptly.



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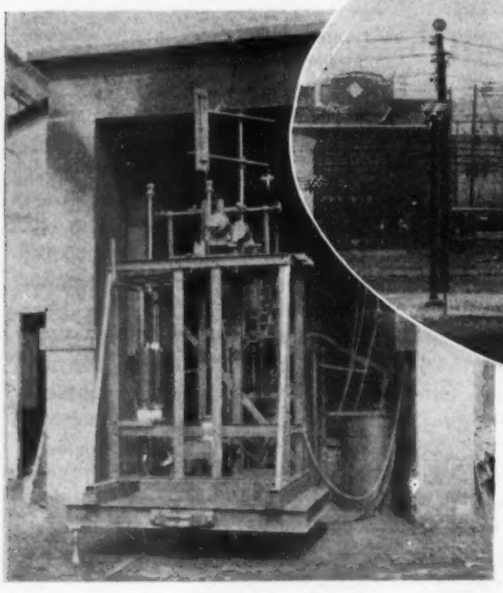
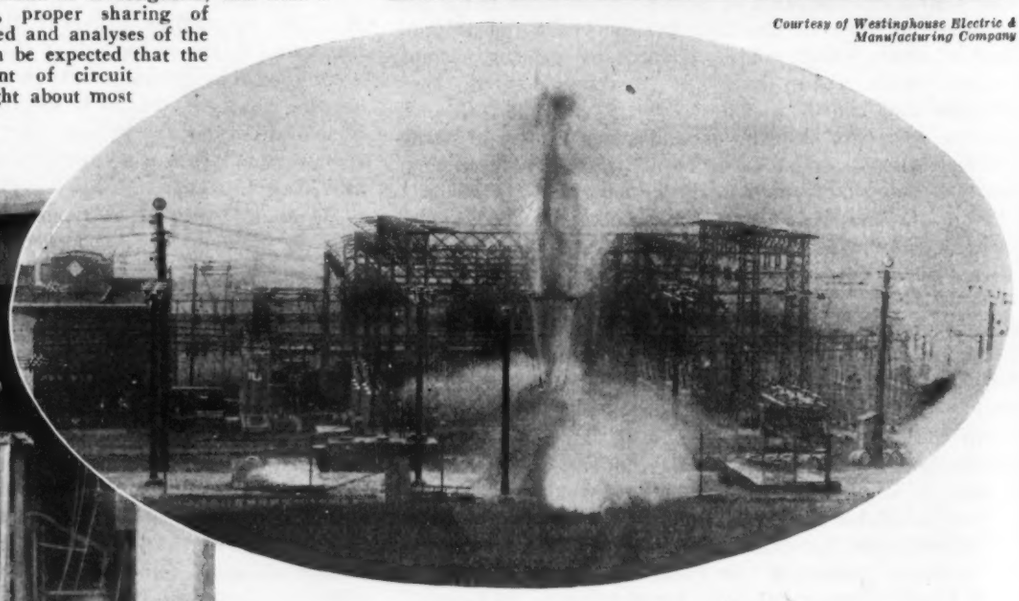




At top—Field facilities for testing large breakers under short circuit.
In center—Laboratory generator supplying current for breaker tests.
In oval—Circuit breaker being tested to destruction in field.
At left—Cell in which manufacturer tests breakers under load.

Winter Convention of A.I.E.E.

Standardization of System Voltages, Results of Circuit-Breaker Tests and Surge Investigation, and Cables, Dielectrics and Corona Receive Particular Attention—Seventeen Other Subjects Included

STANDARDIZATION of system voltages was a subject of outstanding importance at the winter convention of the American Institute of Electrical Engineers held in New York City on Feb. 7 to 11 inclusive. Two entire sessions were devoted to it, viewpoints in the form of a symposium being presented by representatives of manufacturers, consulting and management companies, two groups of interconnected companies and a large distribution system. Still broader in scope were the suggestions made by C. C. Chesney, in his presidential address, for procedure to be followed in formulating all standards in the electrical industry (page 398).

Ranking close to the session on voltage standardization in attention elicited were two other particularly interesting sessions. One of them was devoted chiefly to cables, dielectrics and corona; the other to circuit-breaker tests and surge investigation. To the first session papers were contributed by one light and power company, two manufacturers and two university investigators. Three papers from manufacturers and one from a large utility company formed the program of the second session. Besides these three sessions, there were five others at which subjects were discussed that were primarily of value to designers and persons interested in equipment characteristics. Nevertheless, these discussions are also of value to any one engaged in selecting or operating the apparatus involved. For example, one session was devoted to characteristics of synchronous machines, another to synchronous converters, regulating transformers and machine losses; a third to determination of magnetic fields; a fourth to rectification, telegraphy and wire mills, and still another to elevator drive and meters.

Altogether about 35 papers were presented, with much valuable discussion. Twelve hundred and seventy-five delegates were registered, showing an interest commensurate with the growth of the electrical industry. A smoker, a dinner-dance, inspection trips, a lecture on scientific research now under way and the presentation of the John Scott medal to Gustaf W. Elmen of the Bell Telephone Laboratories rounded out the convention.

Following are outlines of the papers which were presented and their authors, with the high points of the discussions featured. The papers, with the exception of those on system voltage standardization (page 401), are not abstracted here because of their availability through A.I.E.E. headquarters.

Circuit-Breaker and Surge Investigations

"Tests on Oil Circuit Breakers"

PHILIP SPORN and H. P. ST. CLAIR
American Gas & Electric Company

Extensive records of short-circuit tests on oil circuit breakers of several ratings and of three types. The breakers tested were rated at 150 kv., 1,500,000 kva. for the highest rating, to 7,000 volts, 75,000 kva., for the lowest rating. Three types were tested, (1) multiple-break, (2) explosion-chamber and (3) compound-filled. The short-circuit currents available for the tests were sufficient to make the results very conclusive.

"Klydonograph Surge Investigation"

J. H. COX, P. H. MCAULEY and L. G. HUGGINS
Westinghouse Electric & Manufacturing Company

Records of surges obtained by 26 klydonographs operating on many systems, both open-wire and cable, are presented. Records of lightning-arrester performance on certain systems are included. The paper tabulates and analyzes the records of surges according to their magnitude. It further classifies the surges according to their causes, namely, (a) lightning, (b) switching, and (c) interruptions, short circuits and unknown causes. The data are discussed in relation to various theories regarding the production and the elimination of transient high voltages.

"Transmission-Line Voltage Surges"

J. H. Cox
Westinghouse Electric & Manufacturing Company

A number of theories regarding switching and lightning surges on transmission systems are discussed in connection with the information recorded in recent klydonograph field tests on a large number of systems. A number of definite conclusions are drawn on the nature of surges.

The Measurement of Surge Voltages on Transmission Lines Due to Lightning"

E. S. LEE and C. M. FOUST
General Electric Company

Use of photographic Lichtenberg figures in measuring surge voltages is treated. Laboratory calibrations of the figures using the cathode-ray oscillograph and the lightning generator are given with data on the accuracy obtainable. An advanced design employing two recorders is described. Specimen field records of surges as high as 2,000 kv. are shown.

Oil-breaker tests and the measurement of lightning surges were subjects featured at the session on Thursday afternoon. Tests involving short-circuit capacities over 1,000,000 kva. were made on General Electric and Brown-Boveri breakers at 132,000 volts by the American Gas & Electric Company. Other tests involved breakers for 45,000-volt circuits and Reyrolle gear. The 132,000-volt tests showed very satisfactory performance of the breakers, although sufficient capacity was not available to test the breakers at rating. Test procedure, oscillograms and tabulated results were presented completely in the paper by Philip Sporn and H. P. St. Clair, and the authors amplified the paper by showing motion pictures of the tests.

J. D. Hilliard discussed the paper and said that the General Electric Company believed in the policy of informing operating engineers of oil-breaker performance and that tests such as were described were valuable. But he also maintained that test results and procedure should be stated completely and that general conclusions could not be drawn. For a particular system and location only were field tests conclusive. Values of recovery voltage, the effect of local voltage regulation and test variables affect conclusions very materially. In his opinion the tests showed that the explosion-chamber type of breaker was all that was claimed. In the near future the General Electric Company expects to install a 500,000-kva., three-phase generator for breaker testing for customers, and additional capacity would be provided as desired.

R. W. McNeil said that the two-break oil breakers seemed to rupture the line voltage as quickly as the ten-break type. The duration of arcing time seemed to be about 13 to 15 cycles for all the breakers tested, with 18,600, 16,800 and 20,000 volts per cycle of arcing on the breakers. The tests indicated that shorts were maintained with the same number of cycles during arcing independently of whether the system was grounded or ungrounded. In particular tests these cycles were 16.7 with ungrounded system and 15.4 cycles with a grounded system. This appeared to indicate that the insulation of apparatus in the neutral of grounded systems could safely be underrated when ratings were based on theoretical voltage values under these conditions. It was also suggested that

the rate of energy dissipation per contact was the same in the two-break and the ten-break types of circuit breakers as measured by time of arcing.

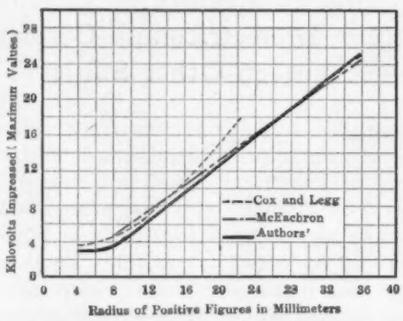
G. A. Burnham said that comparative tests of breakers to be of value should be made at the same location, at the same time and with the same supervision and measurement, personnel and equipment. In his opinion, the energy dissipation per contact in the multi-break type was lower than in the two-break type; otherwise multi-break tanks would be designed much heavier and stronger to withstand the pressures. Yet, as a matter of fact, this was not the case, and therefore the rate of energy dissipation per contact decreased with an increase in the number of contacts.

Lightning Measurements

Several aspects of lightning surges were presented in the other three papers presented at the meeting. Agreement was had that the klydonograph measured lightning surges with reasonable accuracy, and three independent calibrations of this meter showed close agreements.

At the present time field work with the single-electrode and two-electrode instruments had been widespread but unintensified on any one system or locality. Evidence at hand, while not conclusive, indicated that lightning surges and arcing grounds were the only sources of very high voltages on electrical systems. Per storm, per locality, only about two surges could be expected on a line. J. H. Cox, P. H. McAuley and L. G. Huggins drew several conclusions in regard to lightning surge phenomena which were indicated but not yet proved by field data.

In a discussion of the theory of lightning surges, Mr. Cox brought out the Simpson theory as being plausible and as helping to reconcile the data found in field tests. According to Simpson, both positive and negative clouds exist, but, from the ionization theory, the positive clouds are slow in discharging to earth and cause few high-voltage surges to occur. On the other hand, negatively charged clouds discharge very quickly and thus cause



CALIBRATION CURVE FOR POSITIVE LICHTENBERG FIGURES (LEE AND FOUST)

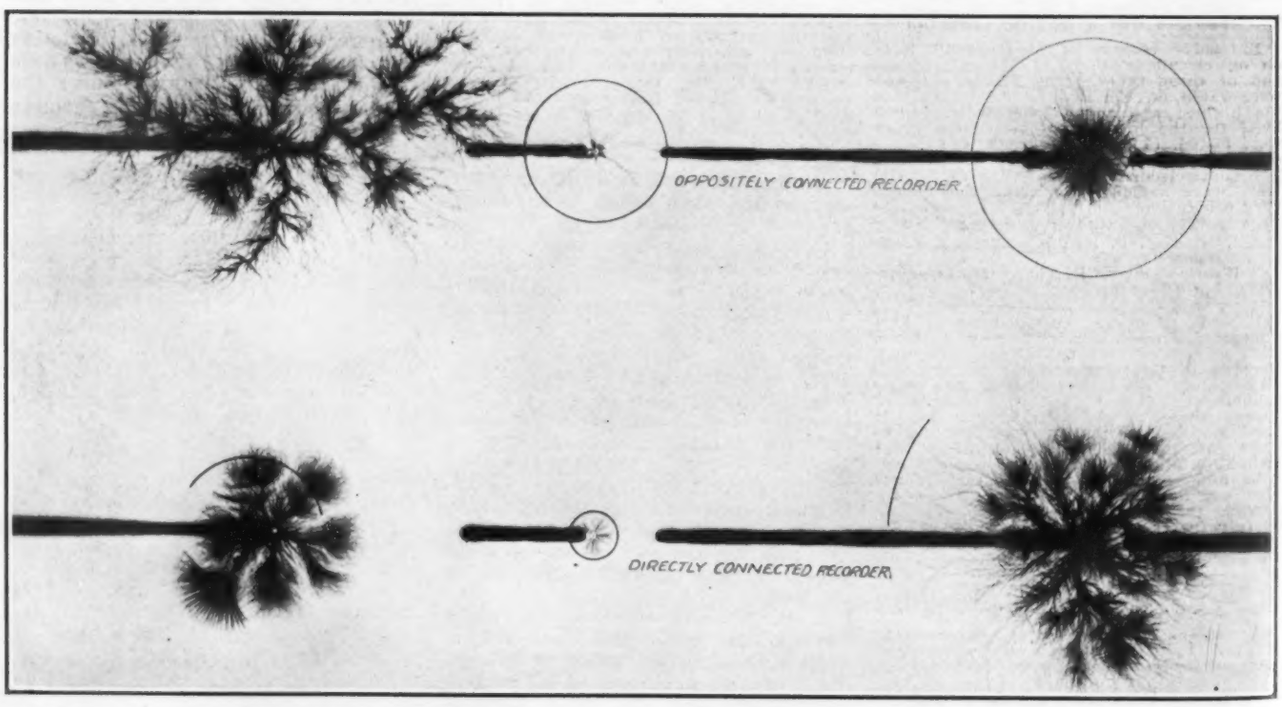
the high-voltage but infrequent surges noticed on lines.

The two-electrode type of surge recorder was described by E. S. Lee and C. M. Foust. This instrument records both a positive and a negative figure for each surge and has an advantage over the single-electrode type in that often a negative surge gives a small figure which is difficult to calibrate, while the corresponding positive figure is larger and capable of more accurate calibration.

W. R. Sherwood discussed the papers. He said that a telephone line 5 miles long had been equipped with eight surge recorders during the last lightning season by the American Telephone & Telegraph Company. In no case during any storm did more than two surges occur. All surges were found to be unidirectional or very highly damped. Both positive and negative surges occurred on the line, and each had steep wave fronts. Of the storms five were positive, three were negative, and three were positive at one end of the line and negative at the other, indicating inter-cloud discharges. No direct strokes occurred. All surges were of short duration. Arresters had little effect in preventing line flashovers when surges occurred at even a short distance from the arrester location. He also urged the use of a separate ground connection for the surge recorder when using it to test arresters, as otherwise only the drop across the arrester was indicated.

K. B. McEachron said that care should be used in making positive conclusions about surges as existing data were merely indicative. He said the type of figure recorded by the klydonograph was a function of time and crest magnitude. Evidence was rather conclusive that lightning surges were about two microseconds in steepness and that voltage magnitudes as a surge developed would determine whether type II or type III figures were recorded. He pointed out also that the reduction of voltage surge magnitudes with travel along a line was not all attenuation. The change from electrostatic energy to an electromagnetic energy would in itself be accompanied by a reduction in the voltage.

J. H. Cox said the two-electrode recorder has certain advantages over the single-electrode type for some applications. But the two-electrode type has a higher capacity, is more expensive when made with multiple electrodes and has errors that may occur because of clock inaccuracies. The nature of tests to be made would usually determine which was best to use. He also pointed out that the use of insulator strings for klydonograph potentiometer connections was subject to errors. When wet, dry or dirty insulators obtained, capacity variables oc-



SURGE RECORD ON TRANSMISSION LINE DURING LIGHTNING STORM (LEE AND FOUST)

curred which would cause large errors in measurements. In his opinion, the condenser bushing offered fine possibilities as it had a high capacity per unit and was constant.

F. W. Peek, Jr., complimented the authors on their papers and expressed his satisfaction with the new measurement devices. He was gratified to find that test results today checked very closely his predictions made several years ago. On a certain line he had recently estimated a maximum lightning voltage of 4,000,000 and a flashover value of 1,800,000. Experience with surges after the line was built checked these values closely. The gradient per foot of line height was a very convenient yardstick to use, and it should be remembered that the flashover value of insulators for 220-kv. lines on 60-cycle tests is nearly doubled for a lightning surge. Only a discharge directly over lines produced very high voltages, and stations should be built at locations not subjected to frequent lightning storms.

Cables, Dielectrics and Corona

"A New 132,000-Volt Cable Joint"

D. M. SIMONS
Standard Underground Cable Company

Describes what is believed to be a new principle in the making of cable joints. Practically all the insulation is applied in one piece by a machine on the job. A new feature is the method of forming a metallic shield within the insulation as it is being applied. The metal shield is built up of thin strips of tinfoil fastened to the paper insulation before wrapping. Test results are given.

"Measurements on Cables and Insulators under A.-C. and D.-C. Stresses"

C. L. KASSON
Edison Electric Illuminating Company of Boston

Records are given of insulation-resistance tests made on cables and insulators with d.-c. and a.-c. potentials. A comparison of values obtained with a 50,000-volt battery and a kenotron is given. The necessity for proper shielding is emphasized and it is shown that the errors in measuring without shields may be very great.

"Oil Breakdown at Large Spacing"

D. F. MINER
Westinghouse Electric & Manufacturing Company

Describes breakdown tests on oil between electrodes separated by several inches. Short-time tests are shown to be very erratic and a long-time test schedule was developed which gives more consistent results. A general equation for breakdown voltages is developed. Evidence is presented to show that water suspended in globular form may increase the breakdown potential considerably with large spacings of spherical electrodes.

"Maxwell's Theory of the Layer Dielectric"

F. D. MURNAGHAN
Johns Hopkins University

Derives an expression for the charging current of a layer dielectric which provides a ready means for using the convenient charging current as a basis for analysis and experimental check.

"Space Charge and Current in Alternating Corona"

C. H. WILLIS
Princeton University

Tells of investigations of the physical nature of the breakdown of gases in corona and of information regarding the space charges from which are derived analytical expressions for the corona current, corona loss and extra capacity due to corona.

The paper by D. F. Miner describing breakdown tests on oil between electrodes separated several inches called forth a wealth of discussion. Those contributing to the remarks represented an interesting divergence of opinion as to what constitutes reliable tests.

The author brought out the point that results of short-time tests were very erratic and unsatisfactory and that a long-time test schedule had to be used to obtain consistent results. Considerable interest was evinced over the statement by the author that water suspended in globular form in the oil may increase the breakdown potential of the oil considerably where large spacings of the spherical electrodes are employed.

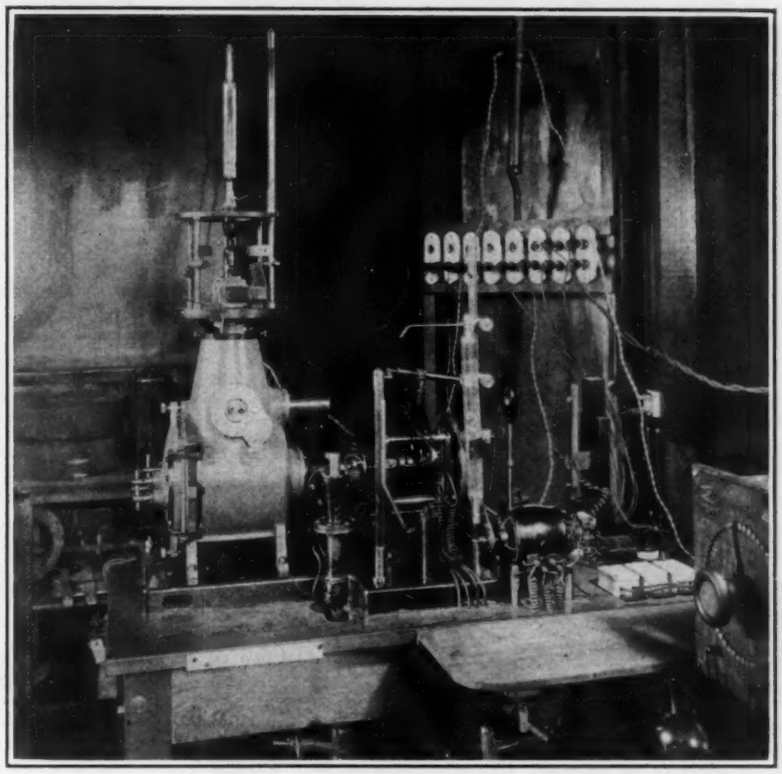
In commenting on Mr. Miner's paper, D. W. Roper expressed it as his belief that industry was forging rapidly ahead of science, as evidenced by the absence of satisfactory methods of testing cable to predetermine definitely where it would be likely to fail. He cited several instances which had occurred within the last year in which cables had failed soon after having passed satisfactorily the usual extensive tests. In this connection he mentioned that frequently manufacturers are able from factory records more closely to approximate the service which a cable would give than any number of the existing types of tests could indicate. He pointed out that one instance of the particular economic value which would be attached to possessing tests of a positive nature was where old cable when being replaced by new was placed in service elsewhere at a lower operating potential. It would be of immense value under such circumstances to know the approximate life service left in the old cable in order to determine whether or not it was economically feasible to install it for further service anywhere.

C. F. Peterson in discussing Mr. Miner's paper questioned the statement that the gradient in oil overtakes the breakdown gradient. He expressed the opinion that it is the oil film that breaks down and that this is independent of the thickness of the oil at any point in the cable sheath.

S. I. Oesterreicher stated that there were several places other than the joint in the cable where breakdown was much more likely to take place owing to dielectric stresses building up to dangerous values.

O. R. Schurig emphasized the consideration that data for small gaps are equally important and that a number of the tests described by the author should in reality be considered as tests over small gaps, owing to a number of specific conditions, which he then outlined. He also disagreed with some of the conclusions which had been drawn by the author, saying that in his experience other conditions than those mentioned might have contributed to obtaining similar results. Mr. Schurig concluded with the statement that under certain conditions water was not necessarily conducive to premature breakdown of oils and that care should be exercised to refrain from conveying such an implication.

R. G. Wieseman complained that the use of different voltages in preparing graphical representations contained in Mr. Miner's paper prevented an evaluation and comparison of the results readily. He urged that in future cable tests those conducting such research undertake to confine themselves to a single method of expressing results of such

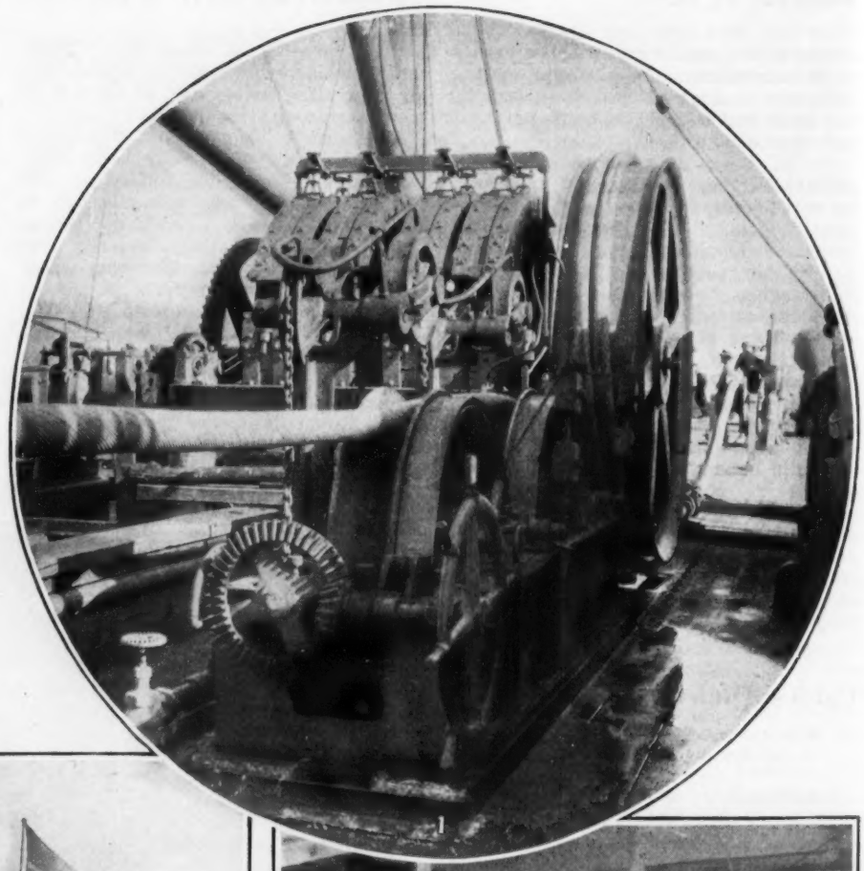


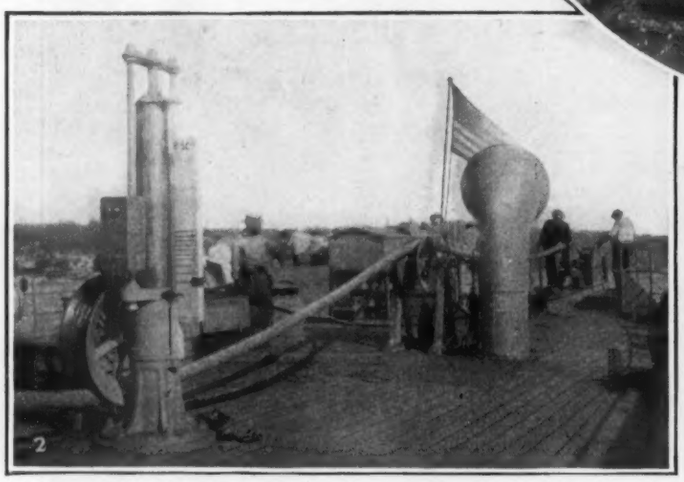
CATHODE-RAY OSCILLOGRAPH HAS MADE POSSIBLE DETAILED ANALYSES OF SURGES (LEE AND FOUST)

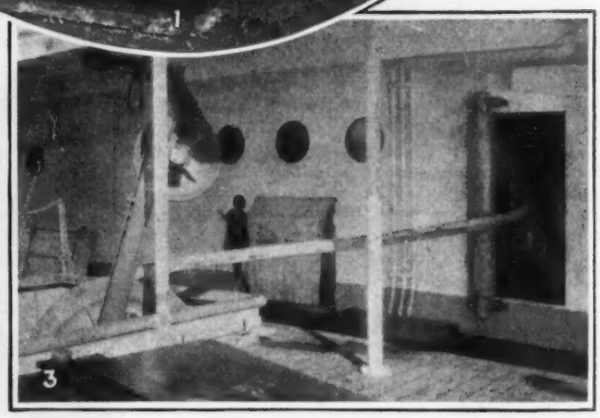
Laying a Deep-Sea Power Cable

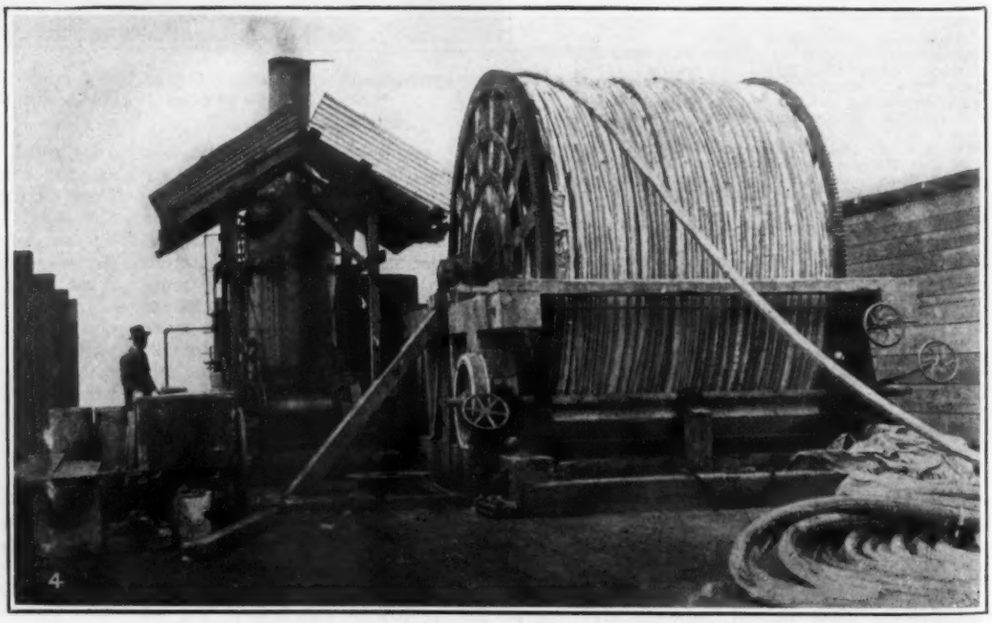
VIEWS taken on board the government cable ship *Dellwood* during the laying of a 15,000-volt, 250,000-circ.mil power cable across the main ship channel in Puget Sound are shown. Two leadless armored submarine cables 4 miles in length were laid in water reaching a maximum depth of 140 fathoms (840 ft.) to connect two parts of the system of the Puget Sound Power & Light Company.

So far as is known, no power cable approaching this one in size was ever before laid in water of such depth. The procedure of laying this cable was described on page 1122 of the Nov. 27, 1926, issue of ELECTRICAL WORLD.









No. 1. Water - cooled brakes maintained perfect control over the tension on the cable.

No. 2. Dynamometer indicated tension in cable.

No. 3. Cable passed over sheave and into cableway after leaving cable tank.

No. 4. Cable-reel geared to donkey engine for picking up and relaying shore-ends in shallow water.

tests so that comparisons between the cable products of different manufacturers might readily be obtained. In commenting on Mr. Miner's paper further, Mr. Wieseman offered an explanation of the higher breakdown values which were found when the water content of the oil was increased by citing from his own experience that it had been found the cable joint diameter was temporarily increased by such additions of water to the oil. He concluded with the opinion that the need was not so much for additional tests on cables but for the elimination of a number of old ones and the substitution of a few more comprehensive new tests.

F. M. Clark said that when commercial oils were purified the dielectric strength became almost completely independent of the spacing. He pressed the point that engineers should be careful in accepting data based on tests conducted on commercial materials, however practical such tests might essentially be.

In closing the discussion on his paper, D. F. Miner emphasized the fact that design information must be for the minimum breakdown point; hence, he said, it was an engineering problem which must not be considered too theoretically.

Prof. F. D. Murnaghan's paper raised the question from Dr. Slepian as to how much actually valuable information about dielectrics such mathematics could supply. He also suggested certain mathematical expressions which in his opinion would simplify the work. He concluded with the statement that the fact that dielectric performance satisfies certain differential equations does not necessarily throw any light on the subject, inasmuch as a number of other individuals had by different mathematical approaches arrived at varying conclusions.

Donald Bratt presented a general solution for a stratified condenser and declared that it was inadmissible to base such solutions on suddenly impressed direct-current voltages.

Professor Kouwenhoven mentioned the research which was now in progress at Johns Hopkins University in an endeavor to secure perfect dielectrics which could then be mixed in an effort to prove or disprove Maxwell's theory.

The paper by C. H. Willis recounted a number of inevstigations which had been made by him upon the physical nature of the breakdown of gases in corona and of information regarding the space charges from which he had derived analytical expressions for the corona current, corona loss and extra capacity due to corona.

In comment Dr. Slepian expressed himself as impressed with the fact that the beginning of corona was found not necessarily to coincide with the beginning of ionization as had commonly been assumed.

Mr. Willis said that certain reactions apparent in the presence of corona contradicted his own previously conceived ideas on the subject, but that by a number of tests the results as presented in his paper had been fully authenticated.

In discussing Mr. Simons' paper D. W. Roper referred to experiences with a few similar cable joints in Chicago. He made the point that frequently patents on different valuable types of cable improvements were held by competing manufacturing companies and suggested that the industry might well take over such patents in order that a co-operative use of them could be permitted for the perfection of cables in general.

C. N. Rakestraw described the use of a conical center-connected type of cable joint and discussed certain test results which he had obtained with this type of cable, where a breakdown value of 50,000 volts higher than that of the author's type of cable joint had been obtained.

E. DeWitt Eby substantiated the claims of the author for the high test values obtained by his cable joints, citing several cases within his own observation in which Mr. Simons' type of cable joint wrapping had proved superior to that mentioned by Mr. Rakestraw. He said that in every case the cable joint had proved stronger than the cable itself. He likewise advocated most strongly an orderly adherence to a generally accepted program of testing to make possible an intelligent comparison of the different manufacturers' products.

Characteristics of Synchronous Machines

"Synchronous Machines—III"
R. E. DOHERTY and C. A. NICKLE
General Electric Company

Deals with the power-angle, or torque-angle, characteristics of synchronous machines under transient conditions. Covers cyclic variation of impressed torque, sudden angular displacement and synchronizing out of phase.

"Sub-synchronous Harmonics on M. M. F. Wave of Polyphase Windings"
QUENTIN GRAHAM
Westinghouse Electric & Manufacturing Company

Investigation of m. m. f. waves in fractional-slot (or other irregular) windings. Deals largely with effects of sub-synchronous harmonics on losses and vibration.

"Transverse Reaction in Synchronous Machines"
J. F. H. DOUGLAS
Marquette University

A method of testing synchronous machines which gives valuable data on their behavior under transverse magnetizing conditions. Following an analysis of results of such a test, a theory of the operation of synchronous machines is proposed. A diagram is offered for determining performance from test data.

"Starting Performance of Synchronous Motors"
H. V. PUTMAN
Westinghouse Electric & Manufacturing Company

The theory underlying the starting performance of the salient-pole synchronous motor having damper windings is covered. Formulas are developed for starting torque, pull-in torque and current inrush. A method of calculating the speed-torque curve is given.

Discussion at this session was almost equally divided among the four papers presented. Perhaps a somewhat keener interest ranged around the treatise on the torque-angle characteristics of synchronous machines under transient conditions as offered by R. E. Doherty and C. A. Nickle and that on the starting performance of synchronous motors by H. V. Putman.

In the paper by Messrs. Doherty and Nickle it was interestingly brought out that if a synchronous machine were operating beyond the angle corresponding to the maximum steady-state power, the machine would be stable under sudden changes, although the steady-state characteristics at that point indicated instability.

Discussion was led by Prof. J. F. H. Douglas, who declared that most texts do not recognize certain useful mathematical methods employed in the paper. E. B. Shand said that increased stability of operation is made possible by the time lag required to move the mechanical system.

Mr. Nickle amplified his remarks concerning the no-load excitation of turbo-alternators with a discussion of the breakdown angle for specific conditions of excitation. He stated that the power developed by two 435-kva. machines was increased from 180 kw. to 440 kw. by hand control of the excitation voltage, which was varied to retain a comparatively steady-state condition of operation. Mr. Doherty said that the paper opens up the possibility of operating synchronous machinery considerably beyond its normal power capacity.

Discussion of Quentin Graham's paper was led by P. L. Alger, who suggested certain simplifications of the formulas used by the author.

Mr. Nickle offered a corrected formula which simplified the results.

Mr. Graham agreed in part with comments of Mr. Alger concerning certain groupings of fractional slot windings which appeared to possess more desirable qualities than those more commonly used, but suggested that such groupings were usually accomplished at the price of permitting the addition of other harmonics to those already present.

Prof. J. F. H. Douglas' paper described a method of testing synchronous machines which the author claimed gives valuable data on their behavior under transverse magnetizing conditions. The zero per cent power factor method of the A.I.E.E. was attacked by Professor Douglas, who undertook to show the simplicity and effectiveness of his own method of analysis.

H. V. Putman, in commenting on Mr. Douglas' paper, asked how the author's method could be applied to three-phase machines, admitting the application to two-phase machines. Reference was made to theories advanced in earlier papers by Blondel, Steinmetz, Karapetoff, Arnold and others. Particular distinction was made in this discussion between synchronous reactance and transverse reaction. Mr. Nickle's comments on the paper dealt with the effect of saturation on the quadrature reaction in the machine, he agreeing with Mr. Putnam on general applications of the method proposed. Mr. Doherty said that it was not so much a difference of opinion which was being expressed, but a difference of definition which was prompting the points of view of the different contributors to the discussion of the paper. Professor Karapetoff said that

the value of Professor Douglas' paper lay in the novel experimental work which had been done, but that the greatest need of the industry now was for more "partial" data which could be put to practical use by the manufacturers.

H. V. Putman dealt with the theory underlying the starting performance of the salient-pole synchronous motor having damper windings. The development of formulas was shown for starting torque, pull-in torque and current inrush. Of particular interest was the method proposed by the author of calculating the speed-torque curve.

P. L. Alger discussed certain limitations to the conditions assumed by the author, particularly his neglecting the effect of stator resistance in drawing certain conclusions. Mr. Graham enlarged upon Mr. Putnam's assumptions, defending them in the light of the successful applications. Answering criticisms, Mr. Putnam justified his use of certain assumptions on the basis that the practical results obtained so nearly checked with theoretical values as to make the use of such assumptions valid.

Converters, Regulating Transformers and Losses

"The Synchronous Converter—Theory and Calculations"

T. T. HAMBLETON and L. V. BEWLEY
General Electric Company

Deals with the internal actions and reactions of the synchronous converter, presenting, first, a simple physical explanation without complicated mathematics and second a complete mathematical treatment by harmonic analysis.

"Constant-Current Regulating Transformer Characteristics"

H. C. LOUIS and ARTHUR ALBAUGH
Consolidated Gas, Electric Light & Power Company

Tests described in this paper show that the losses of constant-current regulating transformers are not necessarily constant at all loads but that the losses at light load may greatly exceed those at full load and may be sufficient to endanger the apparatus.

"Additional Losses of Synchronous Machines"

C. M. LAFFOON and J. F. CALVERT
Westinghouse Electric & Manufacturing Company

Discusses methods of measuring the losses of high-speed synchronous machines under load conditions; gives the results of loss measurements on four 3,600-r.p.m. turbo-generators, and segregates the losses into the different components so as to ascertain the magnitude of the total additional losses.

"Reduction of Armature Copper Losses"

IVAN H. SUMMERS
General Electric Company

A new method of reducing armature copper losses which involves inverting the conductors of a multi-turn coil at one or more places in the end portions of the coil. Formulas and examples of using the method are given.

An outstanding paper at the session on electrical machinery was that on constant-current regulating transformer characteristics prepared by H. C. Louis and Arthur Albaugh. The paper brought out the interesting phenomenon that frequently constant-current transformers which fulfilled the temperature-rise conditions for full-load operation dangerously exceeded them at light loads when leakage flux caused excess losses.

Discussing this paper E. D. Treanor said the big point was that enough constant-current transformers operated at low load to justify attention to light-load losses and consequent temperature rises. To avoid the possibility of confusion in the future his company will base constant-current transformer performance on input-output measurements and it will be emphasized when such data are based on normal windings and when on taps.

J. B. Gibbs said that he had never heard of serious damage from the iron overheating in constant-current transformers and mentioned a scheme using copper plates to suppress eddy currents.

A. F. Handi presented an empirical method for determining the losses due to eddy currents in constant-current transformers and said that results obtained by his method had approximated those of others within one-half of 1 per cent.

Another paper which provoked considerable discussion was that by C. M. Laffoon and J. F. Calvert.

Ivan H. Summers suggested that eddy-current and full-phase losses might account for certain losses not specified by the authors.

"STACK" METHOD OF MEASUREMENT CRITICISED

W. F. Dawson took issue with the authors of the paper on the subject of their "stack" method of loss measurement, outlining briefly certain difficulties which were encountered and should be recognized in determining the accuracy of results obtained. He pointed out that the true average temperature of the inlet and outlet air of a stack must be secured by a careful mapping of the cross-sectional areas. His methods, he said, could ignore humidity, barometric readings and the temperature of the air, all of which had to be taken into consideration in the procedure followed by the authors in their measurement.

P. L. Alger discussed the additional losses under load conditions, assuming certain structural conditions of the machine as fixed.

E. H. Freiburghouse asked if the authors had ever considered the application of a baffle-type mixer to assure uniform temperature of air. He discussed the subject of end-ring material to eliminate load losses, mentioning the fact that in his own experimental work even wood had been tried out to discover, if possible, what effect non-magnetic material and likewise magnetic material exercised. In his own experience, he said, he had found that the use of non-magnetic materials did reduce losses.

In closing the discussion, J. F. Calvert, in co-operation with his co-author, Mr. Laffoon, enlarged on Mr. Dawson's discussion of stack measurement. He said that the method adopted had been selected only after extensive experiments with other types of approach to the problem, none of which had developed as satisfactory means of testing.

Mr. Laffoon explained the apparent discrepancy in results obtained with non-magnetic rings and rings of varying magnetic qualities.

Following the presentation of Mr. Summers' paper, G. H. Rockwood, Jr., presented a simplified method of obtaining results involving the plotting of ratios.

F. D. Newbury read a comment by J. R. Dunbar, which dealt with the transposition of coils, which he believed was too complicated a process and not justified inasmuch as the losses were not decreased enough. Mr. Newbury, adding a comment of his own, said that he believed the method proposed by Mr. Summers was very good for small machines which are commonly machine-wound. In particular, he called attention to the bibliography accompanying the paper, indicating that there had been few contributions on this subject, important as it was acknowledged to be.

C. M. Laffoon read a discussion prepared by Mr. Shand on the paper by T. T. Hambleton and L. V. Bewley, expressing the opinion that the design formulas presented by the authors were not widely applicable, nor so accurate as could be obtained by further analysis.

Magnetic Fields and Reactances

"Graphical Determination of Magnetic Fields"

Three Papers

(a) "Theoretical Considerations"

A. R. STEVENSON, JR., and R. H. PARK
General Electric Company

Explains a mathematical method of analyzing the magnetic field within the conductor surrounding an alternator field pole and gives suggestions for utilizing this method in making sketches of the magnetic fields.

(b) "Comparisons of Calculations and Tests"

E. E. JOHNSON
General Electric Company
and C. H. GREEN
Raytheon Manufacturing Company

Deals with convenient methods of determining experimentally the flux distribution in magnetic fields, particularly in air spaces and in regions occupied by current-carrying conductors.

(c) "Practical Applications to Salient-Pole Machines"

R. W. WIESEMAN
General Electric Company

Shows how the graphical plots of magnetic flux can be used very successfully in calculating the design of electrical machines. It shows the use and great value of such plots in designing a salient-pole synchronous machine.

"Reactances and Transformers Which Carry Direct Current"

C. R. HANNA
Westinghouse Electric & Manufacturing Company

A direct method of designing reactors or transformers to give the greatest inductance when carrying direct current. Includes the determination of the best value of the air gap.

Relative merits of various methods of flux determination raised the most comment in the discussion of the three papers on graphical determination of magnetic fields. It was quite generally remarked that the mathematical method is most accurate, although graphical methods involving iron-filing photographs are of great help in ascertaining the direction of fields where complicated magnetic boundaries occur.

Prof. J. F. H. Douglas expressed the belief that the functions of complex variables are not fully appreciated and that Schwartz and Christofol's theorem of graphical integration for straight-line boundaries might profitably be investigated. He strongly advocated the use of templates for determining flux diagrams, saying that they expedite the work and give excellent results. However, Messrs. Stevenson and Wieseman, who have to make flux determinations frequently and almost continually, contended that template determinations require too much time and are more expensive than free-hand or graphical determinations. Both Mr. Linder and F. Calvert emphasized the necessity of graphically determining the flux paths in elemental or typical magnetic circuits to expedite the calculation of more complex circuits. These graphical determinations can later be checked for accuracy by the mathematical method. Mr. Linder illustrated some typical magnetic circuits in which the flux had been determined by the iron-filing method. Mr. Johnson warned that iron-filing flux analysis, while giving excellent qualitative results, may convey incorrect quantitative results as the filings may cluster where the field is strongest. The method by which Mr. Johnson determined flux paths inside conductors may not always be applicable for other cases. C. M. Laffoon declared that he had been using flux determinations to calculate losses.

D.C.-A.C. Coil Design

C. R. Hanna's paper on design of reactances and transformers which carry direct current drew forth the comment from W. E. Prince that he was interested to see a frontal attack on empiricism. What is a real measure of reactors carrying direct current? he asked. It is proportional to *LI*, he declared, and there appears to be a maximum desirable air gap theoretically equivalent to 4 per cent of the mean magnetic path. Such a large percentage may not be economical to use, however, because it involves too large a proportion of copper to iron. A balance must be struck. For economical design Mr. Prince declared that he employs a group of curves that take into account the ratio of alternating-current component to direct-current component. Professor Douglas contended that both Mr. Hanna's paper and Mr. Prince's suggestions still embodied trial-and-error methods. He favored working primarily from fundamentals.

The paper by A. R. Stevenson and R. H. Park consisted in the extension to more complicated magnetic shapes of a method instituted by Professor Rogowski. The authors undertake to combine a strictly mathematical method with the theory of images and with free-hand sketching into one consistent system of equations which gives mathematical expressions for the lines of force in the part of the field which cannot be so easily sketched. Illustrations were given of the application to problems with rectangular boundaries and also to problems with circular boundaries. It appears reasonable to believe the method can be extended to an even wider range of problems by expressing the equations of Poisson and Laplace in more complicated systems of co-ordinates than indicated here.

Communication, Rectifiers and Wire Mills

"A New Electronic Rectifier"
L. O. Grondahl and P. H. Geiger
Union Switch & Signal Company

A new type of rectifier which depends on electronic action at a junction of copper and copper oxide. The theory of the rectifier, its rectification ratio, efficiency and capacity and its possible fields of application are discussed.

"Measurement of Telegraph Transmission"
H. Nyquist, R. B. Shanck and S. I. Corey
American Telephone & Telegraph Company

Methods which have been developed for measuring the distortion of telegraph signals and interpreting the results.

"Telegraph Traffic Engineering"
H. Mason and C. J. Walbran
Western Union Telegraph Company

Some of the problems confronting the traffic engineer of a telegraph company including wire layout as determined by available routes, circuit loads and capacities; traffic routing, both the economical aspect and the practical methods of issuing routing instructions; central office layout having regard for the various operating methods employed; and operator assignment for a predetermined grade of service.

"Developments in the Manufacture of Copper Wire"
J. R. Shea and Samuel McMullan
Western Electric Company

Interesting developments in copper-wire manufacture including copper-rolling and wire-drawing. The outstanding features in plant arrangement which contribute to more efficient and economical operation are also discussed.

The paper by L. O. Grondahl and P. H. Geiger on a new electronic rectifier aroused by far the most discussion at this session. While on an investigation of copper oxide formed on a piece of copper, during which current was passed through the oxide in a direction at right angles to the surface of separation, it was observed by the authors that the resistance of the combination was less when the current flowed from the oxide to the copper than when it flowed in the reverse direction. In the first unit the ratio of the resistances in the two directions was about three to one. The phenomenon was so different in nature from anything that had been observed in other known types of rectifiers that an intensive study and experimental investigation was undertaken with the resultant development of this new type of charging unit.

A rectifier element consists of a disk of copper on which has been formed a layer of copper oxide. Satisfactory electrical connection is made with the exposed surface of the oxide layer by means of a terminal member of soft metal, such as lead or metal foil. The copper disk and the terminal member of soft metal are conveniently designed in the shape of washers and assembled on a bolt to provide a good connection between the outer surface of the oxide and the metal washer.

The rectification process would appear to be restricted to a microscopically thin film at the junction between the copper disk and layer of copper oxide and takes place with an entire absence of electrolytic action or other observable physical or chemical changes. Each rectifier disk element represents a relatively small increment of charging potential and may be assembled with others into groups for obtaining any desired value of current and voltage. As brought out in the discussion, this rectifier gives a smooth rectified current which appears very much as though it had been commutated by means of a perfect commutator. The rectifier is very constant in its characteristics, requires no electrolyte and does not involve any moving parts or contacts which have to be made or broken.

In the paper by H. Nyquist, R. B. Shanck and S. I. Corey a description was given of apparatus with which the distortion of telegraph signals can be measured. The development and engineering staffs of the Bell system have made use of this type of equipment with such satisfactory results as to make it appear of considerable value for a variety of tests, according to the author.

Elevators and Meters

"A.-C. Elevator Motor Drive"
E. B. Thurston
Haughton Elevator & Machine Company

Some of the developments made in designing an elevator for successful operation on alternating current. Two special features discussed are (1) a motor with high-resistance rotor and (2) a non-sealing a.-c. solenoid.

"A Stroboscopic Method of Calibrating and Checking Watt-Hour Meters"
H. P. Sparkes
Westinghouse Electric & Manufacturing Company

Makes use of markings on the meter disk which are observed by means of a rapidly flickering light. Practical outfits embodying the principle are described.

"Compensation of Temperature Errors in A.-C. Watt-Hour Meters"
D. T. Canfield
Purdue University

Employs thermostatic control of the magnetic drag and the lag adjustment of the meter. Bimetallic strips are used for mounting a magnetic flux diverter and a lag plate.

H. P. Sparkes' paper, presented at the closing session, caused a great deal of favorable comment. It dealt with an optical method for facilitating watt-hour-meter testing. Although the device as described is considered to be still in the experimental stage, consistent average accuracies well above those obtained by present-day methods are asserted to have been secured, along with a definite reduction in the cost of calibrating and testing the meters.

D. T. Canfield in his paper considered the use of compensating devices completely to correct a watt-hour meter for changes in temperature under varying conditions of load. According to his investigation the compensating devices found to be most effective for meter error should be employed in conjunction with bimetallic strips so arranged as to permit automatic correction for temperature changes.

New Procedure to Formulate Standards*

President Chesney Suggests Adoption of New Methods for Drawing Up Additional Standards by the Institute—Establishment of Regulations by Committees Representative of Industries Concerned Is the Issue

By CUMMINGS C. CHESNEY
President American Institute of Electrical Engineering

IN THIS country and in Great Britain the term "standardization" has grown to mean, in the minds of engineers, not only a simplification in the number of types and sizes and the securing of interchangeability but also the laying down of performance rules or codes for all types of apparatus, including measuring instruments, prime movers, generators, transformers and motors. Thus, broadly, the term "standard," in addition to being a measure of quality of standards of comparison, means a common unified practice, method or dimension, which it is to the interest of industry and the community to adopt. Back of any policy of standardization is primarily the purpose to furnish the public a better article or to render it a better service at a lower cost.

Better nation-wide utilization of our industrial resources and efforts will be the outcome of a wide and broad policy of standardization of our industrial products, all being for the ultimate purpose that a greater and greater number of people may enjoy those comforts and conveniences which modern industry has introduced into life; thus not only maintaining the present standards of living but aiming to improve these standards of living for both factory workers and farmers by placing production on a more stable footing.

Institute Standards Recognized as Authoritative

The American Institute of Electrical Engineers since the formation of its original committee[1] has through its standards committee taken the initiative in the formulation of all electrical standards of America, and its work is recognized as being authoritative throughout the entire world. Its procedure and its resulting standards during this period have been acceptable to the manufacturing and the consuming interests as well as to the general public. The industry has learned to value and to depend upon the A.I.E.E. standards in commercial transactions covering matters of interest to all sections of the electrical industry. It has made no attempt to dictate to industry, but introduces standards on any particular line only when it is clear that all interested parties agree that the step is wise and desirable.

In the institute standards committee, or in its subcommittees, the manufacturer and purchaser and the general interests come together and develop the required standards in a way that has been generally satisfactory to all the interested sections of the industry. The electrical standards so issued have been identified with the name of the institute, and its name should be continued in connection with them, and in the interest of simplicity and order it would appear that no other name was actually necessary. It should be remembered that the institute as an organization has no interest other than one of public service, which duty the institute has performed throughout the entire period of 28 years at its own expense. The institute, therefore, in connection with the voluntary formulation of electrical standards, has assumed obligations during the past quarter of a century to the electrical industry and to the public that would make it now embarrassing, if not impossible, to discontinue the present practice or lessen its responsibilities until a more simple and direct method has been devised and demonstrated.

Position of the Trade Associations

Standardization problems today are greater in number and more intricate in character on account of the more complex forces actuating our industrial life, and recently there has been a feeling among some of our members and by interests outside of the institute that a change in organization and procedure for the proper and more rapid handling of standardization matters was needed. Trade associations have sought to obtain greater influence and more authority in the formation of electrical standards which had heretofore been formulated by the institute. This has led to controversies between the institute and these trade associations, and jurisdictional disputes thus arising have naturally handicapped the work and progress has been delayed. It has been affirmed by the representatives of the trade associations that "the trade associations have already become the most important factor in the standardization movement and their importance is steadily increasing." It is also suggested by the same interests that the professional societies' standardization efforts should be confined to scientific fundamentals and to exceedingly important pioneer work. Naturally, the suggestion that the institute and other professional bodies, expressed in the language of another, "be relegated to the field of scientific fundamentals and to association with only government departments" does not set well with the many friends of the institute who know the service it has rendered in this line.

In line with the action of the board on Feb. 9, 1926, and Dec. 10, 1926, and having for its object the establishment of an organization within the institute and a procedure that will be in keeping with the traditions and the established policy of the institute in matters

*Excerpts from President Chesney's address at the winter convention of the A.I.E.E., New York, Feb. 7-10, 1927.

[1]Electrical standardization began as early as 1882 in Great Britain and by this institute in this country more than 28 years ago by the appointment of its first committee on standardization, consisting of Prof. Francis B. Crocker, Dr. Cary T. Hutchinson, Prof. A. E. Kennelly, Dr. J. W. Lieb, Dr. C. P. Steinmetz, L. B. Stillwell and Prof. Elihu Thomson—all outstanding names in the electrical engineering fraternity. The first standards for electrical machinery generally followed by the American electrical industry were those prepared by this committee and adopted by the institute in June, 1899.

of electrical standards and broadly acceptable to the electrical industry, the president—assisted by members of the standards committee and others—has suggested a plan of reorganization of the standards committee and modifying the procedure as follows:

PLAN OF REORGANIZATION

Explanation.—The object sought is the establishment of an organization within the institute and a procedure that shall be in keeping with the traditions and established policy of the institute in matters of electrical standards and broadly acceptable to the electrical industry.

Organization.—The standards committee will consist of 40 members appointed by the president as follows: Twenty from the membership of the institute at large, ten members of the institute nominated by the N.E.M.A., ten members of the institute nominated by the N.E.L.A. The president shall appoint the chairman and secretary. (NOTE)—It is recognized that the N.E.M.A. and the N.E.L.A. do not completely represent the manufacturers and users. Therefore the president, in appointing the first mentioned twenty members, will provide, as far as practical, for representation of the other interests.

From the first-mentioned twenty members the president shall appoint at least one member to membership on each of the institute's technical committees and three delegates and three alternates to constitute the institute's delegation on the main committee of the A.E.S.C.

Executive Committee.—The chairman, the secretary and three other members of the standards committee designated by the president will constitute the executive committee of the standards committee. The function of the executive committee shall be to handle and direct such matters as may be specifically assigned from time to time to it by the standards committee. All acts of the executive committee shall be reported to the committee at its next subsequent meeting for final approval.

Meetings.—The standards committee shall hold meetings at intervals of not more than two months. The executive committee shall hold meetings at such places and at such times as may be necessary to facilitate the general administrative work of the standards committee.

Procedure.—The initiation of a standard or the preparation or the revision of a standard may be made by any group regarded by the standards committee as competent, such as:

1. Any institute technical committee.
2. The N.E.M.A., N.E.L.A., A.E.R.A. and any other allied or interested organization.
3. The A.I.E.E. standards committee.

When, in due course, a standard, prepared as indicated above, is submitted to the standards committee for adoption, a procedure will be adopted to insure its thorough examination and consideration by all interests. When the desires of all interested bodies or groups have been ascertained, the standards committee will endeavor so far as possible to have these desires comprehended within the standard. When, in the opinion of the standards committee, this has been accomplished, the standards committee will recommend to the institute board of directors the approval of the standard as an A.I.E.E. standard.

Publication.—The standard, when approved, shall be published as the A.I.E.E. standard, and the publication shall include a statement which briefly but clearly will acknowledge the work of the collaborating bodies and individuals.

Approval by A.E.S.C.—When in the opinion of the standards committee any institute standard should properly be presented to the A.E.S.C. for approval, the standards committee shall recommend to its board that procedure be undertaken in accordance with the board action of Feb. 9, 1926.

Relation to A.E.S.C.—In the case of standards that are partly electrical and partly concerned with some other field of engineering the institute standards committee shall employ A.E.S.C. procedure as set forth in the A.E.S.C. constitution, either accepting sole sponsorship for the A.I.E.E. or agreeing to the sole sponsorship of one of the other professional societies.

For all electrical standards the institute is instructing its delegates on the main committee of the A.E.S.C. to request and accept only sole sponsorship as directed by the board in its action of Dec. 10, 1926.

This plan contemplates that if and when it is of vital commercial importance to have a generally accepted standard in the electrical field, the difficult and expensive initial work will be done by some one of the trade associations. The adjustments will be made in the A.I.E.E. standards committee, in which the entire electrical industry is represented and which is vouched for by the institute, one of the great professional engineering societies. When, in the opinion of that committee, the desires of all interests are sufficiently comprehended within the standard, it will be recommended to your board for adoption as an institute standard.

Such a procedure would combine the commercial impetus, the financial resources, the management and the recognition and support of the trade associations with the judicial influences of the professional engineering organization. It is believed that the high character of institute standards would be conserved and that the greatly enlarged standardization requirements of the modern electrical industry would be promptly and satisfactorily fulfilled. The institute would maintain for the conduct of its standardization work an office staff that would be small but adequate for its part of this work. The trade associations would provide the very much greater and more expensive staff facilities for the large amount of work involved in their part of the undertaking.

The acceptability of the standards thus furnished to industry would be due both to the expert specialist effort applied to them under the spur of commercial incentives and to the judicial adjustment procedure to which they would be subsequently subjected under the auspices of the professional engineering society.

For some kinds of standards a trade association of manufacturers could most effectively take the initiative; for other kinds, a trade association of users. The preferable course will be evident from the special circumstances of each case.

It is felt that the A.I.E.E. should be regarded in effect as the authorized representative of the A.E.S.C. for standards in the electrical industry, and adoption as A.I.E.E. standard should not need to be followed by approval of A.E.S.C. in each case. If, however, for legal or other reasons, such approval is desirable, the A.E.S.C.'s constitutional procedure is available as indicated in the plan that has been here presented.

HIGH POINTS OF ADDRESS REAFFIRMED

The features that I have tried to emphasize today are:

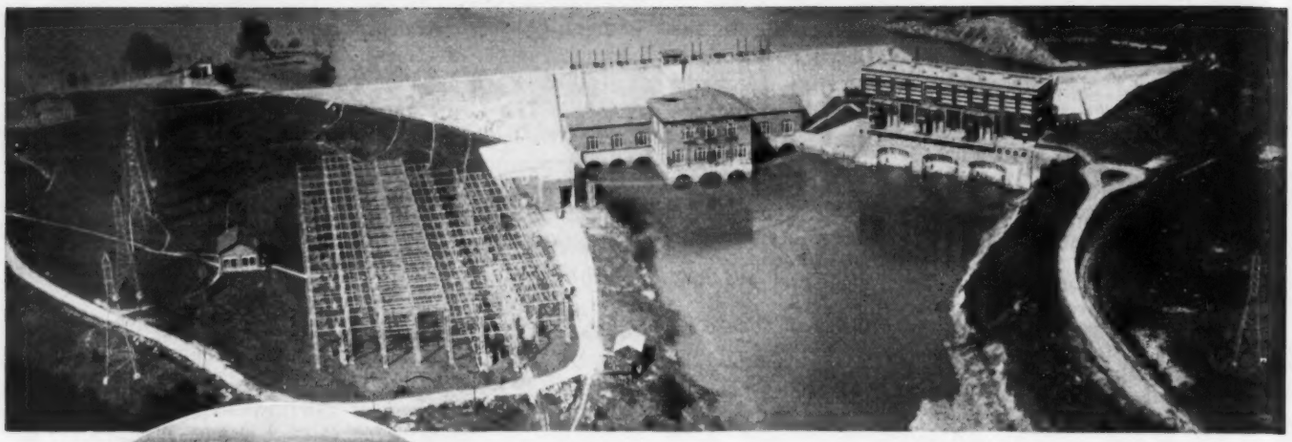
1. The great need that electrical standardization should be actively and aggressively pushed ahead. Industry and prosperity demand this.

2. The great prestige of the American Institute of Electrical Engineers as a standards-making body—won after 28 years' successful experience in this field—is outstanding.

3. Is the board policy sound, as stated in its Dec. 10, 1926, resolutions, to submit the preparation of a standard solely and preferably to a professional engineering body if any be in existence?

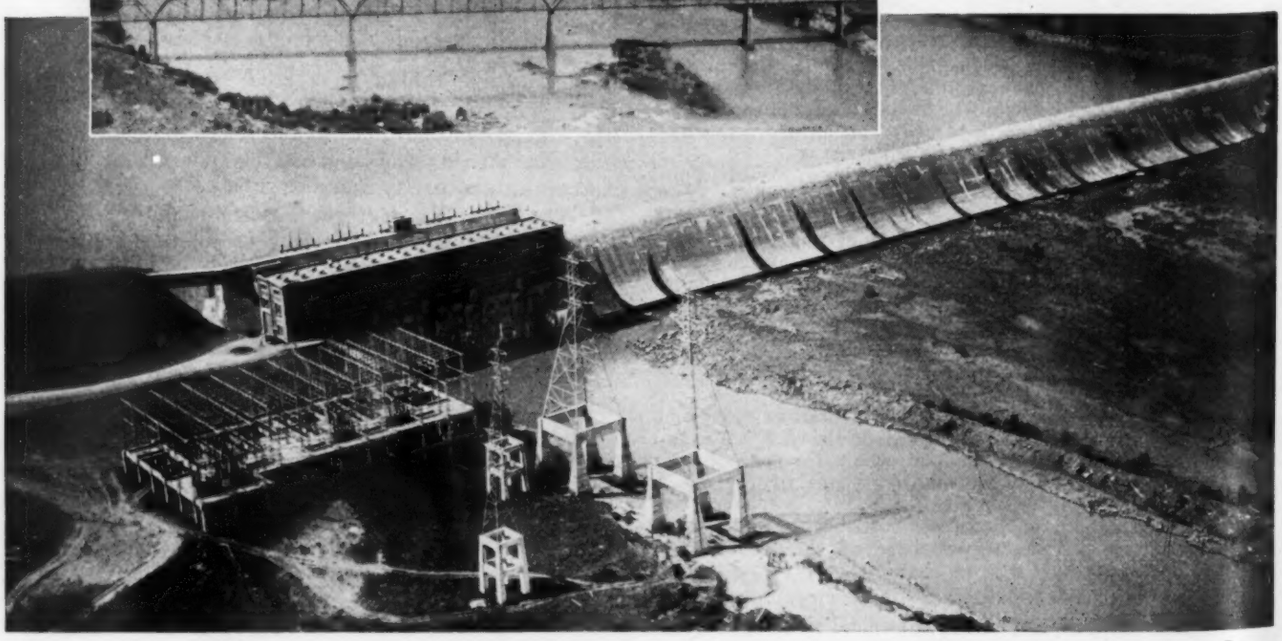
4. Or is this great organization ready to step aside and surrender the formulation of all electrical standards, except those having to do with "scientific fundamentals," to the direction of the several trade associations that feel they are ready to undertake the work?

I have not touched on the international standardization subject; it is another subject, but is receiving much consideration.



Water Power Serves Industry in the Carolinas

THE complete development of the Catawba River by building a series of dams and pools has changed the river from a flash stream to one with a uniform flow throughout the year. The Southern Power Company has built a large system to supply industry in this region and the water power of the Catawba has brought about an unprecedented industrial development. The stations are of a unit type with the generators and turbines as practically the only equipment housed inside the power house. High-tension lines at 110,000 volts convey the energy to the load.



Can System Voltages Be Unified?

This Question Was Analytically Discussed in Symposium at Institute Meeting by Manufacturers and Operators—Various Suggestions Offered, but Difficulties Remain to Be Ironed Out

TO PROVIDE some basis whereby it may be possible to formulate a method of simplifying, unifying or standardizing the great variety of system and equipment voltages, a symposium on the subject was presented at the winter convention of the A.I.E.E. in New York City, held on Feb. 7-11 inclusive. Two entire sessions were devoted to discussion which brought out some very interesting information and suggestions.

All were in agreement that great benefits would come to the industry and public as a whole if practices could be unified, but the financial burden or limitations on individual companies or groups seemed to constitute a barrier to rapid progress toward a solution that would be mutually satisfactory. It was also quite generally agreed that any standard voltages adopted should be based on the utilization voltages with provision for voltage drop between generator and customer. However, there were many phases of the subject on which there were diverse opinions, chiefly because of the investment in equipment of various voltages, the expense of changing or supplementing with new standards, questions as to operability with any proposed schemes, etc.

Before anything tangible in the form of unification can be accomplished it was pointed out that fundamental principles on which all can agree should be determined. Then the argumentative points can be discussed with the viewpoint of fitting in as much of the off-standard or special equipment as possible, but always with the ideal in mind which will bring about standardization and the resulting lowest expense for new equipment.

MANUFACTURERS' VIEWPOINT

According to F. C. Hanker[1] and H. R. Summerhayes[2], who jointly presented two manufacturers' viewpoints, it has been estimated that there is roughly $500,000,000 to $1,000,000,000 worth of special electrical apparatus in use in the United States, which has cost the industry approximately $100,000,000 to $200,000,000 more than it would have done if there had been unity of system practice permitting the use of standard apparatus.

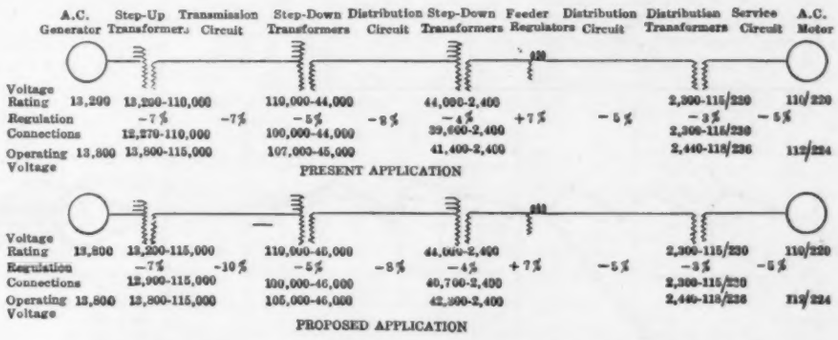
A system of voltage standards is proposed which starts with already standardized utilization voltages at the low end of the scale and suggests transformer voltage ratings and ratios which will allow proper voltage to be supplied to the consumers without overexciting any of the transformers or generators in the system, and ties in the transformer and apparatus voltages with system voltages, based on the A.I.E.E. definition of rated circuit voltages.

[1]Westinghouse Electric & Manufacturing Company.
[2]General Electric Company.

The salient features of the proposed standardization are as follows:

Step-down transformer secondary voltages from 115 volts up to 69,000 volts will be multiples of 11.5, excepting transformers supplying 2,400-volt systems, which will be rated 2,400 volts. For higher voltages step-down transformers will have secondary voltages in multiples of 11 or, in order to enable the step-down transformers to deliver these voltages, their primaries will be rated in multiples of 11 up to 66,000 and above that multiples of 10½.

Step-up transformers, excepting the 2,400-volt class, will have their high-tension windings rated in multiples of 11½ up to 69,000, and multiples of 11 above that, whereas their low-tension winding will be rated 5 per cent lower than the system voltages or generator voltages.


A.C. Generator
Step-Up Transformers
Transmission Circuit
Step-Down Transformers
Distribution Circuit
Step-Down Transformers
Feeder Regulators
Distribution Circuit
Distribution Transformers
Service Circuit
A.C. Motor
Voltage Rating 13,200 13,200-110,000 110,000-44,000 44,000-2,400 2,300-115/230 110/220
Regulation −7% −7% −5% −8% −4% +7% −5% −3% −5%
Connections 12,270-110,000 100,000-44,000 39,600-2,400 2,300-115/230
Operating Voltage 13,800 13,800-115,000 107,000-45,000 41,400-2,400 2,440-118/236 112/224
PRESENT APPLICATION
Voltage Rating 13,800 13,200-115,000 110,000-46,000 44,000-2,400 2,300-115/230 110/220
Regulation −7% −10% −5% −8% −4% +7% −5% −3% −5%
Connections 12,900-115,000 100,000-46,000 40,700-2,400 2,300-115/230
Operating Voltage 13,800 13,800-115,000 105,000-46,000 42,200-2,400 2,440-118/236 112/224
PROPOSED APPLICATION

PRESENT AND PROPOSED VOLTAGE RATINGS TO GIVE STRAIGHT-LINE GRADIENT ILLUSTRATING EFFECT OF FULL LOAD (SCHOLZ, EBERHARDT AND JONES)

To make the step-up and step-down transformers interchangeable would require 25 per cent range, which would involve too great an expense if applied to all transformers.

Another manufacturing viewpoint, presented by A. Huber-Ruf,[3] took into account the situation on the European Continent. He dealt chiefly with the necessity for star-delta change-over of machine and transformer windings.

CONSULTING AND MANAGEMENT ANGLE

Comments from the consulting and management companies' viewpoints were presented by R. E. Argersinger[4] and by A. E. Silver[5] and A. L. Harding[5] respectively. The importance of having transformers interchangeable as step-up and step-down units was stressed by Mr. Argersinger, who proposes 5 per cent taps above and below rated voltages in both windings to attain this flexibility.

Considerable stress has been laid on the matter of buying power, because with the rapid increase in system interconnections it is almost essential to have trans-

[3]Brown Boveri Company.
[4]Stone & Webster, Inc.
[5]Electric Bond & Share Company.

formers wound so that they may transfer energy in either direction. It is also desirable, in order to keep pace with the demands of a growing system, to have transformers suitable for transferring from one part of the system to another. All large power transformers should be designed, therefore, for use either as step-up or step-down units.

In part, Mr. Argersinger's suggestions were as follows:

All apparatus except motors should be rated at a standard system voltage. All motors for use on systems of 600 volts and less should be rated at approximately 8½ per cent less than system voltage. All motors for use on systems above 600 and not exceeding 13,800 volts should be rated at approximately 4½ per cent less than system voltage.

Each winding of all large power transformers should have one full-capacity 5 per cent voltage tap above and one full-capacity 5 per cent voltage tap below rated voltage. Small power and distribution transformers should be rated in accordance with existing standards.

All generators, synchronous condensers, synchronous converters, arc rectifiers, small power and distribution transformers should operate at rated load without exceeding rated temperature rise through a range of from 95 to 105 per cent rated voltage.

All large power transformers should operate at rated load without exceeding rated temperature rise when excited at 7½ per cent above the rated voltage for the winding terminal to which the circuit is connected.

All motors should operate at rated load without exceeding rated temperature rise through a range of from 90 to 110 per cent rated voltage. All circuit breakers, disconnecting switches, fuses and instrument transformers should operate at rated current without exceeding rated temperature rise when used at 7½ per cent above rated voltage.

Messrs. Silver and Harding made their analysis inclusive of all system apparatus, presenting a comprehensive chart showing the voltage zones for elements of representative alternating-current systems and a tabulation of proposed system and equipment voltage ratings which will correct and extend present standards. Among their conclusions were:

1. In developing general voltage standards it must be recognized that there are some systems, particularly those of pioneer origin, which, because of large size and individual characteristics of voltage, will doubtless continue their individual standards and move toward general standards only as the opportunity to benefit arises from time to time in the natural course of replacements and reconstruction. General voltage standards will, in effect, be schedules of preferred voltages, serving as a guide to the maximum practicable uniformity of practice.

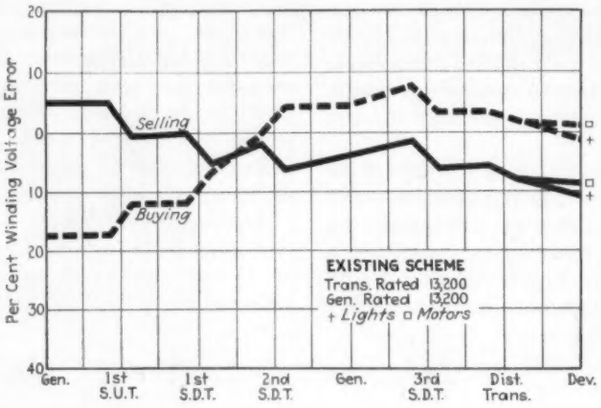
2. In developing voltage standards a fundamental is to establish a suitable reference level or plane for voltage designation. At utilization, or receiving terminals, is the point of maximum inherent voltage uniformity because this is the plane where the product is delivered and service is gaged.

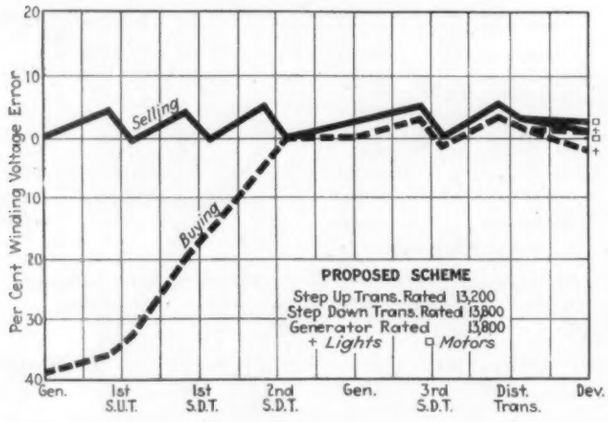
3. Another fundamental is to segregate the power system along functional lines into zones of different voltage levels.

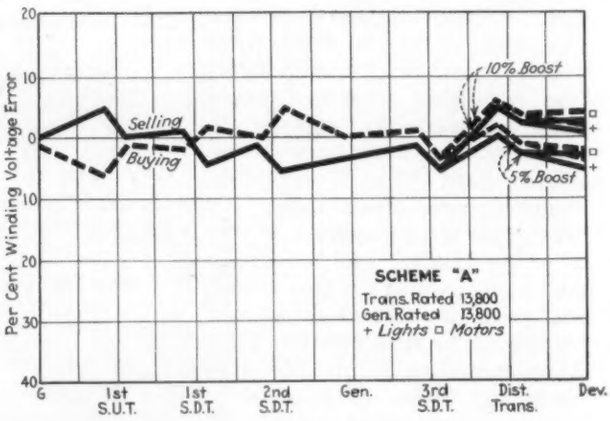
4. A third fundamental is to adhere to present standards and practices in so far as reasonably adequate.

5. A standard lamp and appliance rating of 115 volts and a standard motor rating of 220 volts are assumed.

6. It is important that standard utilization equipment be fully interchangeable between the three-wire delta and four-wire star systems of supply.







APPROXIMATE VARIATIONS IN VOLTAGE OBTAINED AT DIFFERENT POINTS WITH TRANSFORMERS BUILT TO DIFFERENT STANDARDS (ARGERSINGER)

Points in the system are designated as generator (Gen.), first step-up transformer (1st S. U. T.), first step-down transformer (1st S. D. T.), distribution transformer (Dist. Trans.), device (Dev.), etc.
Scheme A is intended to reduce the number of standard ratings, permit the interchangeability of step-up and step-down units, and bring rated transformer and operating voltages closer to system and winding voltages respectively. The conditions labeled "Proposed Standards" apply to manufacturers' proposed standards.

The more important features of the voltage standards proposed include:

(a) The present twenty-to-one ratio for 2,300-volt distribution transformers is retained, but normal rated voltages are raised from 2,300 to 115 and put at 2,400 to 120.

(b) Both ratio and normal rated voltages are changed for the distribution transformers of the 13,200-volt class.

(c) Three types of transformers are established for each voltage class, each having a ratio specific to its own functional duty. These types are service step-down, supply substation step-down, and step-up.

(d) Transformer ratings are such, in relation to circuit voltages, that excitation on full winding is correct when the transformer is located at the beginning or lead-

ing edge of a load area. Taps in 5 per cent steps are provided for compensating regulation across the load area.

(e) The present range of 10 per cent buck and 10 per cent boost for feeder regulators is retained.

(f) Normal rated voltage for generators is raised approximately 5 per cent from present standards, and a normal operating range from plus 10 per cent to minus 10 per cent is required.

(g) Present normal rated motor voltage is retained, and a normal operating range from plus 10 per cent to minus 10 per cent is required.

(h) General apparatus, such as feeder regulators, switching equipment and lightning arresters, is rated for normal operation at 10 per cent above nominal system voltage.

(i) A 5 per cent emergency tolerance above rated maximum operating voltage for all equipment is required.

COMMENTS FROM OPERATING GROUPS

Both the Southeastern and Pacific Coast interconnected operating companies were heard from in a paper by H. J. Scholz,[6] W. W. Eberhardt[6] and S. Murray Jones[6] and a report by H. H. Minor.[7]

From the Southeast came suggestions for modifying the manufacturers' proposed standards to make them more adaptable in that section. These changes, the reasons for which were discussed in extenso, consist of:

(a) Addition of 103,500-volt class.

(b) Uniform voltage ratings, multiples of 11.5 throughout.

(c) Changes in apparatus ratings to make them identical with system voltage ratings.

(d) Providing equivalent of one 2½ per cent full-capacity voltage tap below normal, and equivalent of two 2½ per cent full-capacity taps above normal in the primary winding of step-up transformers to take care of transformer regulation in excess of 5 per cent, and location of transformers adjacent to, or remote from, load centers.

(e) Addition of 7,200/12,470 Y-voltage class for rural distribution systems.

The Pacific Coast report expressed the opinion that the proposed standards are a great improvement over the old and the principles upon which they are based are sound. However, a need was voiced for the inclusion of a 3,980-volt step-down distribution transformer and for a change in the 6,900-volt and 11,500-volt class to bring them into conformity for operation on the same 11,500-volt lines. Furthermore, there is a distinct need of the standards including transformers rated for Y-connection as well as delta connections on standard systems. Clarification of the meaning of emergency operation and more study of the advisable range of taps on step-down transformers were considered advisable. The elimination of 11,500-volt systems is not at all in keeping with Pacific Coast practice, it was reported. Data were submitted to show the kva. connected at different voltages.

Some limitations to the manufacturers' proposal were submitted by H. B. Gear[8] viewed from the standpoint of distribution, stressing the advisability of uniform ratios at all voltages and provision for two-way energy transfer. He said in part:

The complete picture of an average system would reveal several circuits taken off at the generating station delivering energy at the generator voltage level. It would also include additional lines taken off at the 132/66/13.2-kv.

[6]Alabama Power Company.
[7]Chairman Pacific Coast Electrical Association sub-committee on transformer standardization.
[8]Commonwealth Edison Company.

TABLE I — CONDITION WHICH WILL OBTAIN WHEN BUYING AND SELLING POWER BASED ON EXISTING AND TWO PROPOSED STANDARDS
(Argersinger)

Point of Consideration	Existing Scheme 4-2½ Per Cent HT Taps			Proposed Scheme			Scheme "A" 1-5 Per Cent Tap Above and Below Each Pri. and Sec. Voltage		
	Rated Winding Volts	Actual Voltage	Winding Volt Error Per Cent	Rated Winding Volts	Actual Voltage	Winding Volt Error Per Cent	Rated Winding Volts	Actual Voltage	Winding Volt Error Per Cent
SELLING									
Gen.	13,200	13,800	+ 5	13,800	13,800	0	13,800	13,800	0
1st	13,200	13,800	+ 5	13,200	13,800	+ 5	13,100	13,800	+ 5
S.U.T.	132,000	131,200	0	132,000	131,200	— ½	138,600	138,700	0
12 kv. drop									
1st	119,000	119,200	0	113,400	119,200	+ 5	125,400	126,700	+ 1
S.D.T.	66,000	62,800	— 5	69,000	68,800	0	69,300	66,500	— 4
4.5 kv. drop									
2nd	59,400	58,300	— 2	61,000	64,300	+ 5½	62,700	62,000	— 1
S.D.T.	13,200	12,300	— 7	13,800	13,800	0	14,490	13,600	— 6
600 v. drop									
3rd	11,900	11,700	— 1½	12,600	13,200	+ 5	13,100	13,000	— 1
S.T.D.	2,300	2,150	— 6½	2,400	2,400	0	2,415	2,275	— 6
5% boost		2,260			2,520			2,390	
100 v. drop									
Distr.	2,300	2,160	— 6	2,300	2,420	+ 5	2,300	2,290	0
Trans.	115	106	— 8	115	118	+ 2½	115	113	— 2
Drop 3 v. to lts. 6 v. to mte.									
Lights	115	103	—10½	115	115	0	115	110	— 4½
Motors	110	100	— 9	110	112	+ 2	110	107	— 2½
BUYING									
Gen.	13,200	10,900	—17½	13,800	8,450	—39	13,800	13,630	— 1
1st	13,200	10,900	—17½	13,200	8,450	—36	14,490	13,630	— 6
S.U.T.	119,000	104,000	—13	132,000	89,000	—32½	125,400	124,000	— 1
12 kv. drop									
1st	132,000	116,000	—13	126,000	101,000	—19½	138,600	136,000	— 2
S.D.T.	66,000	61,100	— 7½	69,000	58,200	—15½	62,700	64,800	+ 3½
4.5 kv. drop									
2nd	66,000	65,600	— ½	66,000	62,700	— 5	69,300	69,300	0
S.D.T.	13,200	13,800	+ 5	13,800	13,800	0	13,100	13,800	+ 5
Gen.	13,200	13,800	+ 5	13,800	13,800	0	13,800	13,800	0
600 v. drop									
3rd	12,200	13,200	+ 8	12,870	13,200	+ 3	13,100	13,200	+ 1
S.D.T.	2,300	2,365	+ 3	2,400	2,340	— 2	2,415	2,315	— 4
5% boost	.....	2,480	....	.....	2,465	....	.....	2,430	....
100 v. drop									
Distr.	2,300	2,380	+ 3½	2,300	2,365	+ 3	2,300	2,330	+ 1½
Trans.	115	117	+ 1½	115	116	+ 1	115	114	— 1
Drop 3 v. to lts. 6 v. to mts.									
Lights	115	114	— 1	115	113	— 2	115	111	— 3½
Motors	110	111	+ 1	110	110	0	110	108	— 2

5% drop in each power transformer—2% drop in distribution transformer. Line drops as indicated.

TABLE II—SUGGESTED VOLTAGE STANDARDS
(Argersinger)

Apparatus Generator and Transformer	Motors	System
120	110	120
240	220	240
480	440	480
600	550	600
2,300	2,200	2,300
3,980	3,800	3,980
6,900	6,600	6,900
11,500	11,000	11,500
13,800	13,200	13,800
22,000	.....	22,000
33,000	.....	33,000
44,000	.....	44,000
66,000	.....	66,000
110,000	.....	110,000
132,000	.....	132,000
176,000	.....	176,000
220,000	.....	220,000

TABLE III—MAXIMUM VOLTAGE VARIATION UNDER DIFFERENT STANDARDS, OMITTING DISTRIBUTION TRANSFORMER
(Argersinger)

	Per Cent System Voltage Error	Per Cent Winding Error
Existing scheme	+ 5	+ 8
	—21	—17½
Proposed scheme	+ 4½	+ 5½
	—36	—39
Scheme "A"	+ 5	+ 5
	— 6	— 6
Selling only		
Existing scheme	+ 4½	+ 4½
	—11½	— 7
Proposed scheme	+ 4½	+ 5½
	—10	— ½
Scheme "A	+ 5	+ 5
	— 6	— 6

levels, having various percentages of line drop, which must be taken into account in fixing the setting of transformer taps. Certain of these branches will deliver a pressure above or below normal during certain parts of the day. This can be avoided by the use of tap changing devices operable under load, and such auxiliary equipment must be included in the completed picture of the situation.

The necessity of having a considerable range of control between light-load and full-load conditions suggests the desirability of having as wide a range as is economically feasible in the generator voltage.

The plan of adding 5 per cent to the secondary as a part of the fixed ratio of a transformer cannot be followed on tie lines. In such lines the transformers must meet the voltage requirements of both step-up and step-down transformers and must be equipped with pressure taps adjustable under load. This requires a pressure range of 15 to 20 per cent in either direction.

ALTERNATING-CURRENT NETWORKS

A special phase of system activity that needs standardization was brought up by H. Richter*, who discussed quite extensively the relative merits of different types of combined light and power alternating-current secondary networks from an economic viewpoint. He called attention to the increasing use of such networks, and particularly to the attending diversity of choice which, if allowed to continue, may present an extremely complicated situation—so much so that the industry as a whole may have to shoulder a heavy expense that will tend to cancel part of the savings attributable to the combined systems.

DISCUSSION

To indicate the tendency toward a standard socket voltage and also the possibility of unifying practices where considerably diverse practice once existed, M. D. Cooper pointed out that nearly 50 per cent of the incandescent lamps sold in 1926 were rated at 115 volts and that 50,000 types and ratings have been reduced to 24,000 varieties, with early hopes of only 18,000 types.

There is just as great need of international standards as there is of national standards, declared C. E. Skinner, who said that the European situation is more complex than in the United States.

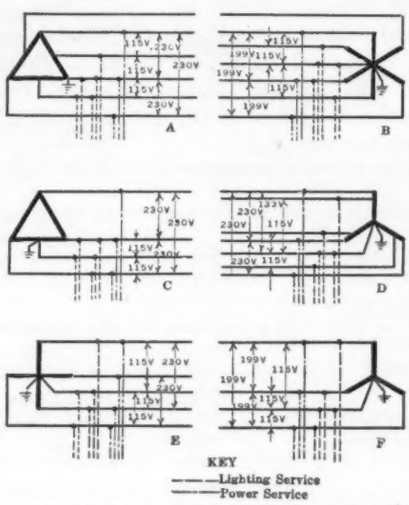
A. H. Kehoe expressed himself in favor of the mean lamp voltage as a basis of reference for system voltage unification, but contended that there is no moral force to bring about standardization. The three common lamp voltages of 110, 115 and 120 must be recognized. "What about companies which have adopted standard equipment in years past?" he asked.

Every one retains a tenacious hold on the eleven-to-one transformation ratio and does not have the courage of his convictions to say what the voltages should be, J. H. Foote declared. The correct basis is the maximum voltage to which apparatus will be subjected under maximum load, he pointed out. Taps are compulsory, not for voltage regulation, but to compensate for failure of the generators to provide adequate voltage. A tap range of from 16 to 17 per cent is required for transmission transformers—none for distribution. Owing to present standards, generator and transformer secondary voltages are too low. Any new standards which will bring unity of practice must provide taps for present uses. There seems to be a dread of changing transformer voltages; instead, ratios are changed. Most ratings are purely nominal; the maximum rating depends on the taps used. Insulators and bushings are needed which will operate at a voltage half way between voltage zones. The result of the proposed standards, Mr. Foote declared, is to introduce three standards. Any new standards must be broad enough to include former standards.

That voltage standards should provide for two-way energy transfer was emphasized by F. L. Hunt, and still another member asked if it were a particular voltage or regulation that should be standardized.

Unification of system voltages is a problem of particular interest to companies which are already engaged or may eventually engage in tying together contiguous territories, B. G. Jamieson commented, so it will be through such companies' co-operation that progress can be made in establishing unification principles.

The essential question to decide is what voltage levels should be selected as standard, Eugene Vinet contended. Greater difficulties will be presented in replacing or supplementing off-standard equipment if the present situation is allowed to continue much longer. He pledged the support of the Middle West Utilities Company to any reasonable unification program, but pointed out that universal support can be expected only through compromises. E. C. Stone warned that the difference in regulation on different systems must be recognized and suggested that many mechanical features, such as terminal boards, tanks, number of taps, etc., might be standardized, leaving the coil turns flexible.



SIX COMBINED SYSTEMS ECONOMICALLY COMPARED (RICHTER)

A preference for twenty-to-one and sixty-to-one ratios for distribution transformers was expressed by Basil Lanphier, with regulation provided at step-down substations.

It is very desirable to have voltage zones established, C. E. Skinner asserted, so that manufacturers can stock parts which can be used. Outlet bushings can be standardized for the maximum operating voltage to which they will be subjected.

R. K. McMaster favored 120 volts as the basis of unification reference, standardization of tap percentage, voltages which will permit either star or delta arrangements except in transmission range and inclusion of the 4,000/115-volt class of transformers.

The Cleveland system is endeavoring to limit its voltages to five, H. L. Wallau announced. He favored 2,300-4,600-volt transformers with 5 per cent taps and provisions for two-way energy transfer in voltage unification.

L. L. Elden reported that regulators have enabled very successful operation of one system involving a wide variety of voltage ratings. He called attention to the uncontrolled regulation of about 30 per cent between generator and customer in the manufacturer's proposal and also asked why unification plans should be based on radial systems when networks are becoming more prevalent. Mr. Elden also suggested that manufacturers, for competitive reasons, are introducing new "specials" continually and preventing unification.

*Westinghouse Electric & Manufacturing Company.

Regarding the frequent suggestion that standards provide for two-way energy transfer, a manufacturer's representative questioned what percentage of all transformers would be involved and expressed the opinion that such transformers would require tap-changing under load and would be of a special nature, any way.

Mr. Hanker urged every one to consider unification as a basis for working to best ultimate system. Where there is sufficient demand for equipment it should be covered in any new standards. If voltage ranges can be standardized, it will be a big help as the turn ratio can be readily changed.

Discussion of combined light and power alternating-current secondary networks centered around the voltages to use. D. K. Blake declared that the 115/199-volt system is the cheapest, affects the smallest number of customers and is adapted to the 115-volt socket standard. If the system is adopted extensively, 200-volt motors will be developed.

Because of public relations, financial and construction situations, P. H. Chase felt that it is impossible to standardize on any one system. Can a utility justifiably ask a portion of its customers to provide voltage equipment different from that of others? he questioned.

H. L. Wallau referred to the enormous expense of changing customers' utilization equipment when adopting any of the existing combined light and power networks. He described a 115/230-volt system which may have possibilities if certain grounding requirements can be modified.

Mr. Kehoe wished to be on record as emphatically opposed to the 115/199-volt system and favoring the 120/208-volt system with 5 per cent variation at the customer's plant. Good public relations, he declared, require that *no* customer be inconvenienced and that equipment be universally applicable in the same territory. On these points he was supported by W. B. Kirk. In Brooklyn, where the 120-volt supply varies from 116 volts to 124 volts, there have been virtually no complaints from motor users, and the system will accommodate motors demanding up to 10 kw. Larger motors are fed from a four-wire system.

Sub-voltage operation of motors is an imposition on customers, declared Mr. Elden, who suggested making motors interchangeable on 200 volts and 220 volts. To this Mr. Blake replied that it might be possible to arrange the motors for parallel Y operation at 125 volts and series-delta at 225 volts.

Letters from Our Readers

Declares Service and Economies Should Determine Return

To the Editor of the ELECTRICAL WORLD:

The public generally does not recognize that utility companies operate under regulation that restricts their return on invested capital to an amount which would be considered very modest, if not unattractive, in other businesses. Neither does the public recognize how diligently these companies work to decrease operating expenses, only to have the consequent increased profit possibly wiped out in subsequent regulatory adjustments of rates. The only inducements to effect these economies and improvements of service are the spirit of service which permeates the industry and the opportunity to capitalize on the savings before a rate adjustment. Many times the savings are passed on, in part at least, to the public through voluntary rate reductions, so that the spirit of service is the motivating influence. With so little reward for effort, it is really surprising that there have been such great strides in economy in a regulated industry.

Even if the foregoing facts were generally known to the public, it would be utopian to expect that of its own volition it would change the situation. Knowledge of these facts might, however, make the public more receptive to a suggestion that regulatory commissions allow a sliding scale of returns on invested capital, dependent on efficiency of management and operation—a nominal and almost unattractive capital return for mediocre service, higher rates for better service.

Might it not be worth while for utilities to suggest such a plan to their respective state commissions? The plan could involve an arrangement whereby the public would share in the savings through reduced rates but the return to capital would not be limited as now. It can hardly be expected that continuance of the present practice can induce the best results everywhere, despite the public-spiritedness of some companies.

Progress on any such plan as the one suggested will require presenting facts to show how the public will benefit, finding a basis on which the sliding scale of returns and sharing of savings with the public can be worked out practically, and discovering a state commission which would be receptive to the idea. Nobody is likely to initiate the plan unless the utilities do so, because it is the utilities which know how the present fixed rates of returns work out for themselves and the public. Started in one state and proved successful there, the plan would spread rapidly to other commonwealths.

A. M. P.

New York City.

Ductile Tungsten and Dr. Fink's Relation to Its Discovery

To the Editor of the ELECTRICAL WORLD:

The account of the recent court decision *re* ductile tungsten printed on page 272 of the ELECTRICAL WORLD of Jan. 29 and the announcement of the Edison medal committee's action, as reported on page 263 of that issue, do not reveal the whole story. Without entering into a lengthy discussion I wish merely to quote from Judge Hugh M. Morris' decision (page 36):

"The present record discloses, on the contrary, that Dr. Colin G. Fink, not Dr. Coolidge, was the one who did the work in the laboratories of the plaintiff upon molybdenum; that Dr. Fink did that work in the summer of 1908 while Dr. Coolidge was abroad; that in doing it he followed his own ideas; that a patent application for his work was prosecuted to allowance by the plaintiff and then abandoned; that molybdenum, a sister or analogous metal to tungsten under the Mendeleef classification of elements, is normally brittle in the same sense that tungsten is and is affected by heat and mechanical forces in the same way. Dr. Coolidge returned to the laboratories in September, 1908. The process by which molybdenum had been drawn was made known to him. Tungsten was drawn for the first time in the laboratories of the plaintiff a few weeks later by the same process and with substantially the same results."

"Tungsten was drawn for the first time" by myself, as is amply shown in the record and as was conceded by Dr. Coolidge.

COLIN G. FINK.

New York.

Central Station and Industrial Practice

Definite Schedule for Inspection

Fourteen Automatic Substations of Pacific Electric Railway Maintained According to Specific Schedule—Card System Serves as Check

BY S. H. ANDERSON
Superintendent of Power and Equipment Pacific Electric Railway, Los Angeles, Cal.

AUTOMATIC substations have been operated on the system of the Pacific Electric Railway Company for seven years with entirely satisfactory results under diverse operating conditions sufficient to test their utility to the utmost. Of the 51 substations on the system fourteen are now automatic.

Upon the installation of automatically operated substation equipment it was immediately recognized that, owing to the exacting service demanded of the automatic devices, their successful operation would be dependent to a large degree upon an adequate inspection system — one that would provide for a rigid routine, which if efficiently supervised would insure effective results. The present practice has been found to be comprehensive in scope, rigid in detail and at the same time simple of application. It represents the evolutionary development of the methods found most satisfactory as the automatic installations were periodically increased in number from one to fourteen since 1918.

Inspection and general maintenance of the system's fourteen automatic substations is performed by six automatic substation inspectors, one of whom acts in a supervisory capacity. In addition to having charge of all automatic inspectors, he is responsible for the compilation of all reports and records, ordering of spare parts and arranging for any heavy overhauling and repairs by the general substation maintenance repair crews. Although the stations are comparatively widely separated, the work has been so equally divided that the various inspections and other duties scheduled can be regularly performed.

GENERAL SCHEDULE PROVISIONS

The general schedule provides that all substations be visited once each day and receive a general inspection without shutting down equipment. Twice each week the equipment is shut down and cleaned and all necessary adjustments are made. Small car-type air compressors are installed in all automatic substations to furnish compressed air for cleaning. A card system has been arranged for each substation that is a positive indicator to the inspector as to his duties. The number of cards for each station varies from nine to fourteen, depending upon the conditions existing at each particular one.

A schedule or key-card indicates the number of the card, specifically describing the duties to be performed on any particular date at the substation in question.

A record is made by the inspector on the back of each card every time the various inspections and adjustments specified are made. A detailed description of the work performed is recorded in the substation log book.

The inspectors keep in close contact with the chief central-station operator, who is directly responsible for the operation of all substations, both manual and automatic. It is necessary that the central station have minute information as to the inspectors' activities and whereabouts. The central station must authorize the actual shutting down and starting up of the equipment, energizing and de-energizing of lines

MONTH _____ YEAR _____

MCH OFF	NO. DAYS INSP.	NO. CYCLES	NO. FAILURES
1			
2			
3			
4			

MONTHLY RECORD CARD FOR AUTOMATIC SUBSTATION INSPECTIONS

KEY-CARD

Period	
Every inspection	Fifth month
Every 12th and 28th	First Thursday
First month	Second Thursday
Second month	Third Thursday
Third month	Fourth Thursday
	Fifth Thursday
Card Reference	No. 3-5-11
No. 1	Miscellaneous
No. 2	No. 4-5-7
No. 3-5-8	No. 4-5
No. 3-5	No. 4-5-9
No. 3-5	No. 4-5-6
Fourth month	Miscellaneous

PACIFIC ELECTRIC RAILWAY COMPANY

Weekly Report of the Operation of Automatic Substations.

5308—1-B

WATTHOUR METER READINGS

SUBSTATION ..... No.				SUBSTATION ..... No.			
DATE AND HOUR	METER NO.	READING	K.W. HOURS BET. READINGS	DATE AND HOUR	METER NO.	READING	K.W. HOURS BET. READINGS
SUBSTATION ..... No.				SUBSTATION ..... No.			

WEEKLY REPORT OF AUTOMATIC SUBSTATION OPERATION

On the reverse side is space for recording dates, causes and location of damage, failure of or renewal of equipment, sanding of commutator or brushes, changes in or adjustment of equipment, etc.

CARD NO. 1

Every Inspection:

INSPECT THE MACHINE THOROUGHLY, Noting:

Commutator; Collector rings;
Brushes;
Position of brush-raising device arm.
Temperature of the following:
Machine transformer;
Machine iron and bearings;
Contactors on all d.c. and a.c. contactors.
See if oil rings are running.
Note if d.c. ammeter is registering.
Look over the entire equipment in a general way and report to central station.
Drain air tanks and inspect air compressors.

CARD NO. 9

Every .....

CLEAN AND INSPECT CONTROL DRUM:

Test tension of all contact fingers, wipe commutators and drum segments and oil drum, gears and motor if needed.

(Caution—Never blow compressed air near commutator ends of auxiliary motors or generators.)

Once a Month:

Inspect and clean oil switch, mechanism and interlocks.
Inspect, clean and oil No. 35.
Remove connecting rod, and grease crank with vaseline.
Test movement of moving collar in brush yoke.

SAMPLES OF INSPECTION CARDS

and all other activities with reference to substation and transmission line operation. All of the pertinent data from the log book and inspection cards are compiled on a weekly report form, and a monthly summary of the inspections, cycles, failures, etc., is tabulated for ready reference and study. Each substation is equipped with a combination graphic recording direct-current voltmeter and ammeter, which show on the same chart when the alternating-current starting and direct-current line contactors come in.

MEN ADAPTED TO THE WORK APPOINTED INSPECTORS

Automatic substation inspectors are selected from the ranks of the manual substation operators and are men particularly adapted to this class of work, being thoroughly familiar with substation equipment and the distribution characteristics of the system. Although the inspectors are responsible for the general maintenance and condition of the automatic stations, all heavy repairs and overhauling work are performed by the regular substation maintenance crews.

Torsion Head Overcomes Wattmeter Error

BY OTTO A. KNOPP
Chief of Bureau of Tests and Inspection
Pacific Gas & Electric Company,
San Francisco, Cal.

RECOGNIZING that the error of dynamometer-type wattmeters, caused by the mutual inductance between the potential and current coils, may be grave in certain laboratory measurements, the Pacific Gas & Electric Company has developed a combination torsion-head and indicating wattmeter* for use in its laboratory tests, which entirely corrects for such errors. When current flows in the potential coil of a wattmeter of the dynamometer type, it sets up a slight potential in the current coil due to mutual inductance between the coils and causes a current to flow. Impedance of the current circuit as a whole determines the value of this current, which either adds to or subtracts from the load current being measured, causing an error. This error is negligible when the impedance of the external current circuit is high, but when the current coil is connected to a shunt or current transformer secondary or other low-impedance circuit the error is appreciable.

The mutual inductance between the moving or potential coil and the stationary or current coil is a maximum when the coils are parallel and is zero when they are set at right angles. Hence the greatest error occurs when the pointer is at zero or at maximum position on the scale. In most modern wattmeters the right-angle position of the coils occurs at the middle position on the scale. Thus by keeping the moving coil always in the position of zero mutual inductance the error can be eliminated.

The accompanying table indicates the possible error that may exist in various types of wattmeters.

POSSIBLE ERRORS DUE TO MUTUAL INDUCTANCE WITH NORMAL POTENTIAL APPLIED

Type Wattmeter	Range Amp.	Range Volts	Range Watts	Watts	Possible Error Per Cent Full Scale
A	5	150	500	4	0.8
B	5	150	750	1.5	0.2
C	0.1	150	3	0.054	1.8

When small deflections of three to eight divisions are being read, the error may be as much as ten or twenty times the percentage value indicated in the table.

When the torsion-head is applied to wattmeters of the dynamometer type, this error is entirely eliminated. As illustrated, it consists of a revolvable pointer and thumb nut fastened in the top of the Bakelite cover of the meter. Its axis is in line with the axis of the moving coil of the meter. The end of the movement spring, ordinarily fastened to the frame of the meter, is fastened instead to the pointer of the torsion head. Tendency of the indicating pointer to deflect one way or the other is offset by placing a torque on

TORSION-HEAD WATTMETER THAT COMPENSATES FOR MUTUAL INDUCTANCE ERRORS

the spring through the torsion head, thus keeping the pointer in the zero position and likewise the coil in the position of zero mutual inductance. The reading in watts is obtained by reading the deflection of the torsion pointer on a specially calibrated scale.

Briefly the advantages of the torsion-head wattmeter are:

1. Torsion scale is uniform over its entire range.
2. Plus and minus readings can be read without reversing the potential. This is an advantage in certain cases where the wattmeter is used as a differential detector, such as in the Silsbee deflection method of calibrating current transformers.
3. Errors due to mutual inductance are entirely eliminated.
4. The wattmeter can be used as an indicating instrument either as a center-zero or left-hand zero by merely setting the torsion pointer on the corresponding zero. (Use of the left-hand zero can be made only in this way if the instrument has a single torsion spring as in the G.E. P-4 and others.)
5. The instrument is much easier to operate than other types of torsion-head dynamometers, as the deflection of the indicating pointer is not restricted to a small part of the scale and large changes in reading are more readily noticed and very easily compensated for.

*Patent applied for.

CLAMP PREVENTS SLIPPING OF PIPE WHEN BENDING

Safeguarding Pipe Bending in Manhole Work

ON THE underground system of the Edison Electric Illuminating Company of Boston service cables are run from street manholes to customers' premises in 2½-in. iron pipe, usually 20 ft. long and buried in the ground. Bending of this pipe is nearly always required on account of obstructions and the location of manholes with respect to cable entrances to buildings. The average bend is about 40 deg. and the maximum usually 60 deg. The degree of bending required is not known in advance and the work has to be done in the field. A device to increase the safety of bending when done on the street has been developed in this connection.

Formerly the usual method of bending was to insert one end of the pipe under the lip of the manhole casting, which is on the ground surface and supports the cover. By pulling the other end of the pipe a bend was secured about 3 ft. from the end inserted in the manhole, the degree of bending being determined by the distance that the pipe is pulled. The principle of bending in this way is satisfactory mechanically, but since the pipe end in the manhole tends to shorten as the bend increases, trouble has often been experienced from slippage, with the result that the men on the outer end lose their balance and fall with the pipe.

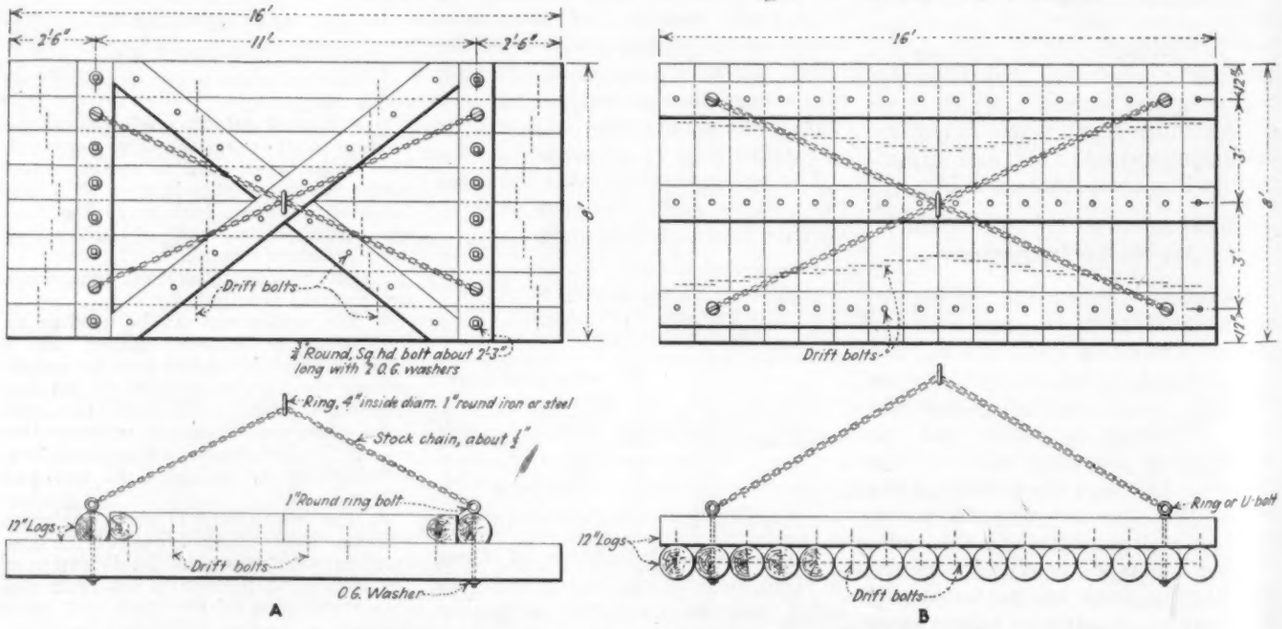
In an attempt to prevent this slipping and to reduce to a minimum unsafe conditions, a holder has been devised consisting of a chain pipe vise bolted to a 2x6-in. by 3-ft. plank, shown in use in the illustration herewith.

The pipe is inserted under the lip of the manhole casting as before, but at the point on the opposite side of the manhole where the pipe is bent, the bending outfit is clamped to the pipe and the handle that tightens the clamp drops inside the manhole casting. With this method the pipe cannot slip, since it is securely clamped in the vise; the handle of the vise prevents slipping backward, and the plank on which the outfit is mounted prevents sidewise sliding. It is hoped that this outfit will reduce the number of injuries hitherto received while bending pipe.

Blasting Mats Made of 12-In. Logs

TWO types of blasting mats made of logs were used in the excavation work at Martin Dam by the Alabama Power Company. In one type the logs, 12 in. in diameter, ran lengthwise; in the other type they were crosswise. In both cases the blasting mats were 16 ft. long and 8 ft. wide.

Cross-members were bolted to all the logs to hold them together, and two chains, each fastened to diagonally opposite corners and passing through a 4-in. ring at the center, were used to lift them.



MATS USED AT MARTIN DAM WHILE BLASTING EXCAVATIONS

Use of Spliced Poles as a Construction Expedient

BY FREDERICK KRUG
Assistant to President Porto Rico Railway, Light & Power Company

IN ORDER to clear its new office building, the Porto Rico Railway, Light & Power Company has had to construct an unusual tower to carry its 22,000-volt lines over the site during construction.

The three circuits shown on the

HOW POLES WERE SPLICED TO OBTAIN CLEARANCE DURING OFFICE BUILDING CONSTRUCTION

tower were carried on 40-ft. steel towers. The new office building, a two-story and basement structure, required a clearance during construction of about 60 ft. After the building is completed it is proposed to mount the upper section of a standard steel tower on the roof, which will obviate the necessity for the structure shown.

No poles longer than 50 ft. were available. Thirty-foot poles were accordingly "spliced" to two of these, resulting in two poles approximately 72 ft. in length. These were mounted as shown, using tropical hardwood 4x6 in. in size for crossarms and the central upright support. The top circuit is No. 4 B & S solid copper wire and the two lower circuits are No. 00 B & S stranded copper wire.

A strain brace of guy wire was placed between the two poles near the splice and three side guys to ground on each side hold the structure perfectly rigid.

Higher ground near the front end of the building site made it possible to raise the lines sufficiently at that point by extending the steel tower supports.

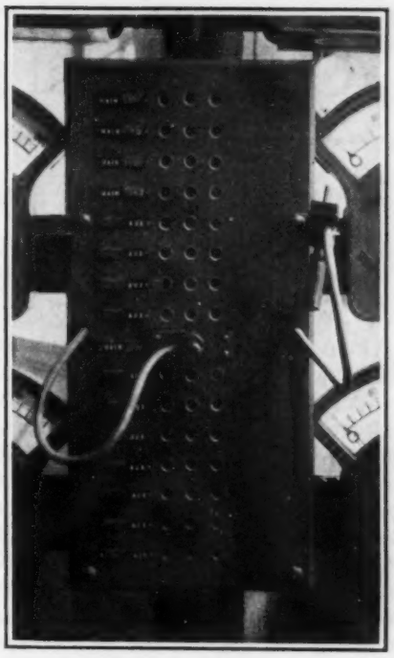
Grouping of Voltmeters Aids Voltage Check

BY RICHARD B. KELLOGG
Assistant Engineer Pacific Gas & Electric Company, San Francisco, Cal.

SUBSTATION operators of the Pacific Gas & Electric Company are aided in checking and regulating voltages at feed points on the Edison three-wire system by the use of an inexpensive voltmeter pedestal or "tree" shown in the accompanying illustrations. On this pedestal are mounted the necessary voltmeters to indicate to the operator at all times junction-box voltages and the voltage (three-wire) of the main and auxiliary buses.

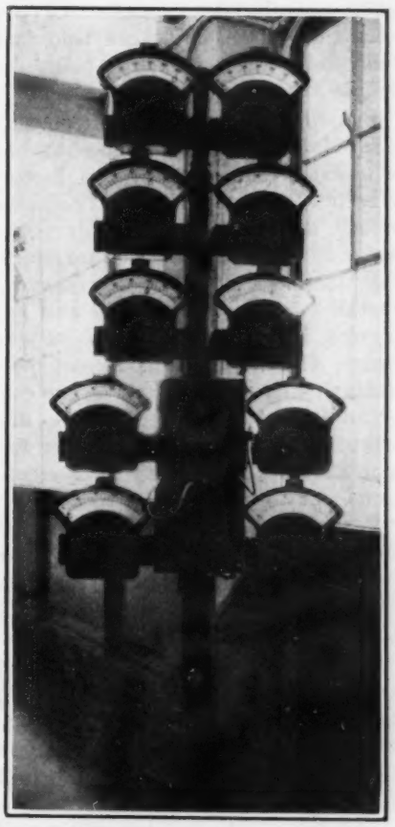
The pedestal consists of a standard base flange and standard sizes of black iron pipe with reducing couplings. The brackets supporting the instruments are welded to the vertical pipe. A slip joint at the bottom allows the whole arrangement to be turned so that the operator may read the instruments from any part of the switchboard room. The hollow base is provided with a handhole cover to allow access to the pressure wires for connecting.

As may be noted from the close-up illustration, the pressure-wire panel and switches are mounted on the pedestal to permit the operator to switch from one pressure wire to another while facing the instruments. The pressure-wire plugs and receptacles are three-wire, one plug being for the main bus and one for the auxiliary bus. Feeder numbers appear on the plate opposite each receptacle. A feature of the number plates is that they slide back and forth over a holder, which reads "main" and "auxiliary." In this



THREE-WIRE PRESSURE-WIRE PANEL AND SWITCHES MOUNTED ON VOLTMETER PEDESTAL

manner the feeder pressure wires may be placed on the main or auxiliary bus and the operator has a permanent check on the proper bus. A fuse panel for the pressure wires is located at the duct line terminal in the subway or basement.



VOLTMETER PEDESTAL AND PRESSURE-WIRE PANEL

Commercial Activities and Public Relations

Electric Range Favored as Load Builder

One Company Reports that 10 Per Cent of Its Residence Customers Use Electric Ranges and Increase Total Domestic Consumption by 40 Per Cent—How Sales Obstacles Were Overcome

AS A LOAD and revenue builder the electric range surpasses all other domestic appliances, in the opinion of one electric power company, which has developed this business to a point where more than 10 per cent of its residence customers use electric ranges and the energy used by these range customers accounts for a 40 per cent increase in residence consumption. Since this company engaged in the sale of appliances about four years ago it has concentrated much of its sales effort on ranges, because, primarily, they offered the best opportunity for increasing gross revenue and also offered a fair margin of sales profit.

This company serves a number of small towns and cities, none having a population of more than 25,000. There are approximately 12,000 residence customers in all, of whom 1,250 use electric ranges—10.4 per cent. Of these 227 were sold last year and the company plans to double that number next year.

Considering the electric range as a revenue producer, the company has established one fundamental factor. Whether the load will be profitable or not depends upon the degree of range saturation in a given territory. For instance, if it is necessary to install a 5-kva. transformer and run service lines to take care of one range, the installation is not particularly attractive. The average cost or additional investment in the distribution system runs between $80 and $100, varying with local conditions. As the average gross yearly revenue from the energy consumption of an electric range has been found on this system to be $54, the ratio of revenue to additional distribution investment is 1 to 2.

But in the more highly saturated areas where there are frequently two to seven ranges served from one transformer the range load is particularly attractive and it has been found that where a single range is sold in a neighborhood it will be followed by three or four others within the next few months.

In placing ranges in the homes of customers the company has had to do a considerable amount of pioneer work and for that reason not every installation shows a profit. This, however, is felt to be a condition that is inherent to the introduction of any new device. Ranges are sold on the deferred payment plan, customers making as large a down payment as possible and the balance spread over ten or twelve months.

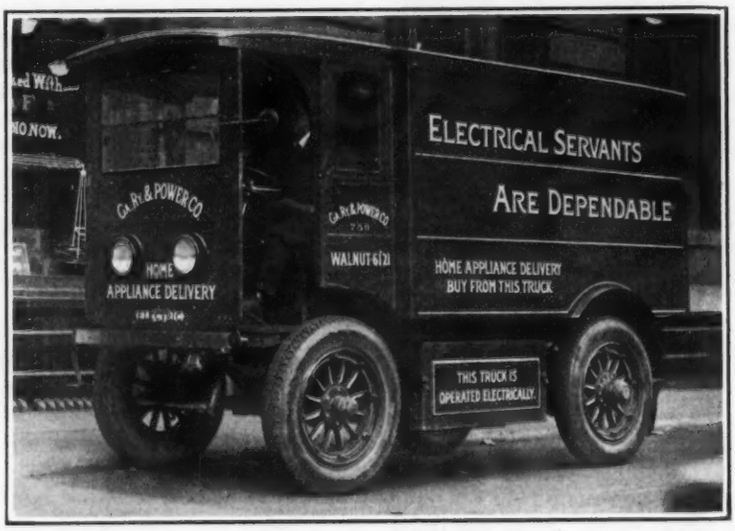
One of the greatest drawbacks to the sale of the electric range has been that the cost of installation has been almost prohibitive. Many companies and dealers selling them have insisted on making a profit both on the range and on the wiring and for every range sold they had to make two sales, one of the range and another of wiring. As it was impossible to give the customer a price on the complete job until after it had been installed, this resulted in the loss of a great many sales because the average customer does not like to take a chance that the total cost will be more than he wishes to pay.

In order to overcome this obstacle and stimulate sales, the company referred to guarantees to the customer that it will not cost more than $25 for the installation unless some unusual condition is encountered. Seldom does the cost to the customer exceed this figure. If it does, the excess is absorbed by the company, and if it is less, the customer is given the benefit of the difference. The company does not expect to make any profit on the wiring, as there is sufficient margin on the range sale to cover any slight loss.

Energy for electric cooking is sold on a domestic heating rate of 3.6 cents and 3 cents per kilowatt-hour, the company serving two distinctly separate territories. To obtain this rate the customer must have a minimum of 3,000 watts connected load. On this rate the average annual revenue per range is $54.

Taking the company's entire territory, the electric range has proved to be an excellent load builder. There are 1,250 ranges installed with an average monthly consumption per

Utility Truck Affords Good Advertising Medium



THREE thoughts are strikingly emphasized in this picture. First, that electrical appliances are dependable; second, that the utility is sufficiently interested in their sale to assist by facilitating personal deliveries; and third, that the organization can and does practice what it preaches by "doing it electrically" when it comes to operating its trucks. Inasmuch as this electric truck was intended primarily to assist salesmen of the Georgia Railway & Power Company in dispensing household electrical appliances in a house-to-house sales campaign, the advertising appeal possessed by the choice of lettering displayed is all the more to be regarded as a happy combination.

range of 135 kw.-hr., or 1,620 kw.-hr. per year. The total annual consumption of electric ranges on this company's lines is something more than 2,000,000 kw.-hr. The company's 12,000 residential customers use approximately 5,000,000 kw.-hr. for lighting, ironing and other household duties. Of these same customers 1,250 are using 2,000,000 kw.-hr. for cooking. Thus the use of electric ranges by about 10 per cent of the residential customers has increased the total domestic consumption by about 40 per cent.

Readings taken on the substation meters in one town of 3,500 show range peaks appearing about 7 o'clock in the morning, 11 to 12 in midday and from 5 to 6 in the evening. These peaks, especially those in the morning and evening, occur at times when the commercial load is comparatively low. Thus the range load tends to smooth out the daily load curve, giving a better load factor for the town. Although other towns have not reached the same degree of saturation, they also show that the range load tends to give a flatter load curve than that produced by purely power, commercial or lighting loads.

Outdoor Lighting Promoted During Holidays

BY W. E. HOLLAND
Sales Manager Dallas Power & Light Company, Dallas, Tex.

AN INTENSIVE promotional campaign involving outdoor Christmas tree lighting was conducted by the Dallas Power & Light Company during the Yuletide season of 1926. The electric service company's activities were most heartily indorsed by civic authorities, community leaders and citizens throughout the city in a manner indicative of a co-operative and most enthusiastic civic undertaking.

The electric company's purpose was twofold—to get before the public an economical and more effective means of outdoor decoration and to keep down additional investment in distribution equipment necessary to tide over the Christmas peak where outdoor Christmas tree installations employ the use of the larger size lamps.

Every electrical merchandiser, contractor and lamp dealer was advised of the activity planned and urged to talk "small series Christmas lights for outdoor decoration." Newspaper advertising was used to offer the services of the illuminating engineering division of the electric service company to the public in planning its outdoor decorations.

LIVE TREES ELECTRICALLY ILLUMINATED SPREAD FESTIVE CHEER

Nearly every conceivable object in front yards was a subject of decoration—hedge, bushes, trees and flag poles. Chimneys outlined with strings of the small series decorative lamps were also found, along with those installations where the residents preferred to confine the element of decoration strictly to the house and outlined entrance arches, windows and house fronts.

In one section of the city 420 installations ranging from four to 30 sets of eight-lamp series strings were counted. In another section there were 210 trees decorated and lighted to the extent of outlining the entire street with a flood of colored light. More than 700 installations were counted throughout the city, showing various communities veritably alive with Christmas lights.

Solicit Service Agreements by Streets

TO CO-ORDINATE the engineering and commercial work required in laying out and constructing services to residences, the Edison Electric Illuminating Company of Boston, Mass., has recently adopted a plan for soliciting service agreements on a street basis of canvassing. The advantages of carrying through a complete street layout in place of the usual piecemeal construction of underground lines and their service taps are obvious. When it is proposed to build an underground line through a street, representatives of the sales department, of which L. R. Wallis is superintendent, canvass the residential occupants on each side of the thoroughfare, notifying each of the proposed development. A 4x6-in. application card is offered to each prospect interviewed, under the terms of which the company is authorized to install underground service to the basement.

The occupant agrees to pay $1.26 per foot for the installation of the service pipe from a point 2 ft. inside the sidewalk line, prior to or on the date on which he is prepared to make use of electric service and before the meter is installed. He also agrees to pay the cost of service wires. A card is available either for payment upon completion of the service run if the prospect prefers, or for deferred payment. This plan speeds up the taking of service and saves money in layout and construction.

Street
Avenue District

Name

No.4 DEFERRED PAYMENT AGREEMENT FOR INSTALLATION OF ELECTRIC SERVICE

The Edison Electric Illuminating Company of Boston is hereby authorized to install underground service to the basement of premises # Street

I agree to pay the sum of $1.26 per foot for the installation of the service pipe on my private property from a point two (2) feet inside of the sidewalk line on said property, said payment to be made as of the date I am prepared to make use of electric service in the premises, and prior to the installation by said Company of its meter for the purpose of supplying me with said electric service.

I understand that service wires are necessary to

(OVER)

OWNER OF PROPERTY SIGNS ON REVERSE SIDE OF DEFERRED-PAYMENT CARD

Illinois Utility Speakers Reach 733,000 People in Year

ORGANIZED public speaking as a means of giving a wide acquaintance with and understanding of utility operations to the citizen at large was started in Illinois six years ago. At first the speaking activities for the whole state were handled from Chicago, but after three years the present district plan was put into operation. The organization of the speakers' bureau consists of a central or state committee directing the work of ten district committees, which function as indicated on the map. Under the district committees are 81 local chairmen, of whom about 50 have formed local committees. In the formal bureau organization are 425 persons in addition to about 400 men and women speakers. Eliminating duplications, it can be said that spreading the utility gospel by word of mouth enlists the services of more than 700 persons. The accompanying tables summarize the results accomplished.

Table II shows that public schools offer the best field for the major portion of the public speaking work. It is estimated that final figures for the year will show this classification to be about 60 per cent of talks made.

Talks before groups of business or professional men in 1926 constituted about 19 per cent of the total for the year. This is surprising in view of the fact that no aggressive effort has been made to serve this particular class during the last two years. Most of the talks have come by direct request of clubs without solicitation. This is an excellent indication of how talks in other classes will continue to be received by the public, as groups of business men were the first audience to be served when the bureau was started six years ago.

TABLE I—SUMMARY OF TALKS SINCE THE INAUGURATION OF BUREAU, JUNE, 1920, TO NOV. 1, 1926

Period	No. of Talks	Audience	Plant Visitors
June, 1920, to Dec. 31, 1923	563	64,745	.....
Jan. 1, 1924, to Dec. 31, 1924	1,291	182,483	34,411
Jan. 1, 1925, to Dec. 31, 1925	2,167	489,822	80,972
Jan. 1, 1926, to Oct. 31, 1926	3,072	688,525	33,149
Totals	7,093	1,425,575	148,532

Total number persons reached in 6½ years, 1,574,107

SUMMARY OF RESULTS DURING LAST TWO QUOTA YEARS

Period	No. of Talks	Audience	Plant Visitors
July 1, 1924, to June 30, 1925	1,930	323,263	30,947
July 1, 1925, to June 30, 1926	3,417	656,869	75,381
Total number persons reached, 1924–25, 354,210			
Total number persons reached, 1925–26, 732,250			

TABLE II—CLASSES OF AUDIENCE SERVED, BY CALENDAR YEARS

	Talks in 1924	Talks in 1925	Talks in 1926 (to Oct. 1)
Public schools	510	1,187	1,420
Chambers of commerce, civic luncheon, business and professional men's groups	312	481	516
Church clubs, neighborhood improvement associations, labor unions, farmer groups, Y.M.C.A.'s, Boy Scouts, fraternal orders	156	160	308
Women's organizations and parent teachers' associations	59	197	229
Radio	56	16	11
College, university and teachers' groups	22	65	59
Miscellaneous	176	61	225
Totals	1,291	2,167	2,768

PUBLIC SERVICE SPEAKERS' BUREAU DISTRICTS IN ILLINOIS

Numerals and heavy lines on the map indicate the number and boundaries of each district.

The central committee is now attempting to open up two other fields for speaking work—chautauquas and farmers' institutes. Should these groups accept the offer of co-operation, approximately 100,000 persons may be added to the aggregate audience each year, judging from results secured so far.

Compound Rates Stimulate Residential Use

STEADY gains in the use of electricity by residential customers of seven Eastern light and power companies during the past five years are shown in the accompanying table, which also reflects the influence of compound rates in the development of this class of business.

The electric service utility listed as B, showing the largest gain, 35 per cent, over 1922, was a pioneer in the introduction of the compound rate, although not the first to apply it in the state where it is located. In 1922 this company held third place. Company E, which had the lowest usage in 1922, gained 44 per cent in the five years and has now advanced to fifth place despite its large rural service component.

The company indicated as C does not merchandise appliances. Recently Company A has adopted an area-energy rate, D is studying residential service costs, E has adopted a combination rate limited by the requirement of a range or water heater, and G has put into effect a combination rate. All these companies exchange data monthly and none is more than 250 miles from any other. The managements of all the companies are aware that the totals shown for the year represent but a modest portion of the attainable usage, and during 1927 the application of the compound type of rate will undoubtedly change the positions of some of these friendly contestants for first place in the monthly statistical interchange.

COMPARISON OF RESIDENTIAL USAGE IN SEVEN COMPANIES, 1922–1926 INCLUSIVE, SHOWING EFFECT OF COMPOUND RATES

From Data Sheets Exchanged Monthly

	Total Kw.-Hr. Per Residential Customer					—Per Cent Gain in 1926 Over—				Kw.-Hr. Per Capita (1920 Census)	Ratio Population to Residential Customers
	1922	1923	1924	1925	1926	1925	1924	1923	1922		
A	332.4	347.4	347.6	347.8	371.3	6.8	6.8	6.9	11.7	64.9	5.2 to 1
B	285.9	316.0	341.7	357.4	385.9	8.0	12.9	22.1	35.0	102.9	3.6 to 1
C	298.2	306.8	323.7	329.4	352.3	7.0	8.9	14.8	18.1	84.8	4.0 to 1
D	259.2	280.9	292.1	305.4	316.4	3.6	8.3	12.6	22.1	75.1	4.0 to 1
E	221.0	231.1	258.9	281.6	318.2	13.0	22.9	37.7	44.0	61.8	5.0 to 1
F	259.9	273.0	284.2	303.8	322.0	6.0	13.3	17.9	23.9	80.2	4.1 to 1
G	228.9	230.1	235.0	243.5	275.5	13.1	17.2	19.7	20.4	54.7	4.8 to 1

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Automatic and Remote-Controlled Water-Power Plant.—DIPL.-ING. MEINERS.—The factor determining whether a water-power plant shall be entirely automatic or remote-controlled, or to what extent both methods should be used in conjunction, is governed by the distance between the controlled and controlling stations. The author of this paper continues in detail to discuss a number of cases, describing the conditions for which the different types of control are best suited. The simplicity of small plants makes their automatic work considerable. On the other hand, the complications of large and important plants and the increased working reliability of precise automatic control form the reason for the employment of this system in these plants, the saving of working cost in this case being no longer of decisive importance. —*A.E.G. Progress*, December, 1926.

Swiss Twin Generating Stations.—In the upper Rhône valley in Switzerland there is an interesting twin-station hydro-electric plant where a constant output is assured throughout the year by combined operation of a lower station for service during the summer months and an upper station which derives its water supply from a storage lake. The lower plant, operating under a head of 2,381 ft., has at present a capacity of 20,000 hp., comprising two 8,000-kva., 750-r.p.m., Pelton-wheel-driven generators. The upper station receives its water from the storage lake situated 7,708 ft. above sea level, under a head of 2,933 ft., driving two 4,200-kva. generators. Three hundred feet below the storage lake has been erected a motor-driven pumping station where three 500-hp. pumping sets transfer water from a small lake into the upper, artificially dammed reservoir. The sets are driven by induction motors, the speed of which can be regulated between 900 r.p.m. and 1,470 r.p.m. This wide range of speeds was necessary owing to the greatly varying head between the levels of the two lakes. Data are given on the transformers and the switchgear used in the stations.—*Bulletin Oerlikon*, Nos. 63 and 64, 1926.

Generation, Control, Switching and Protection

Protective Relays in Large Systems. —R. ARNOLD.—In this article the author examines critically the large variety of electric relays which form essential protective features in modern systems. Writing from the purely operating standpoint and apparently basing his conclusions upon a vast amount of collected practical experiences, the writer offers many useful suggestions for the simplification and the correct installation of relays. After a chapter on general properties and uses of relays twelve main types are described in detail. Differential protection and selective-type relays are treated with particular attention. In the last chapter a tabulation of faults is given and the best-suited relay is recommended for each fault.—*Elektrotechnik und Maschinenbau*, Dec. 19, 1926.

Transmission, Substations and Distribution

Cable Condensers.—S. SILBERMANN.—The use of lead-sheathed cables, reeled on drums and provided with adequate potheads, as power condensers is very tempting, but more general application is prevented either by too high cost or by a rather limited voltage. The new cable construction recommended by the author greatly diminishes both of these objections. Hitherto high-voltage cables had one central conductor, around which were wound a sufficient number of layers of special oil-treated paper until the necessary thickness of dielectric between wire and lead sheath was reached. The result was that the innermost layers of the paper were overstressed, while the outer layers could have been stressed more. To bring the stress to a more uniform value, the new cable has metallized layers alternating with insulating layers. Wherever the cable is spliced certain of these metal layers are connected in a metallic manner. Cables of this type can now be built for operating voltages up to 110,000, and condensers made from it cost between 30 and 50 gold marks per kilovolt-ampere.—*Elektrotechnische Zeitschrift*, Nov. 11, 1926.

Modern Viewpoints for Substations. —H. PUPPIKOFER.—The convenient and safe arrangement of all necessary apparatus in substations for medium and high voltages has undergone far-reaching changes during the last ten years. After a short retrospection, the author gives a condensed description of new viewpoints for the most satisfactory layout of substations. A large number of photographs and plan drawings give examples of recently finished stations and apparatus. For installations over 50 kv. the plain outdoor type of station seems to be the most satisfactory and least expensive proposition.—*Bulletin de l'Association Suisse des Electriciens*, December, 1926.

Fire Hazard of Large Transformers. —C. H. S. TUPHOLME.—Power transformers have steadily increased in size until at the present time units containing upward of 5,000 gal. of oil are not uncommon and, as the oil is combustible, the question of fire hazard has been raised. According to the author, consideration of this subject suggests that the hazard with modern designs is "potential" rather than "actual." He lists the following three conditions as necessarily in existence before a fire can start: (1) The temperature of the oil must be at or above its ignition point; (2) air must be present; (3) there must be a source of ignition, such as an arc. The article contains a discussion of the use of pipe for the relief of tank pressures.—*Electrical Review (England)*, Dec. 10, 1926.

Units, Measurements and Instruments

Some Experiments with High-Voltage Cathode Rays Outside of the Generating Tube.—W. D. COOLIDGE and C. N. MOORE.—This paper consists of a description of a few of the experiments that have been tried with the new cathode-ray tube. Among the experiments, the general results of which are described herein, are: (1) Raying of diamonds, (2) raying of fused quartz, (3) X-ray study of color change produced in halite, (4) cathode-ray scintillations, (5) depth charge in various insulators, (6) cathode-ray shadow pictures of delicate tissues, (7) chemical effects, (8) action on bacteria, (9) action on fruit flies, snails and cockroaches, (10) effect of cathode rays on plant tissues, and (11) effect of cathode rays on animal tissues.—*Journal of Franklin Institute*, December, 1926.

Illumination

Modern Arc Lamps.—G. LAUE.—The sudden decline of the arc lamp in favor of the incandescent lamp was not, according to the author, due to a superiority of the latter, but was brought about after the war by a lack of skilled arc-lamp tenders. City administrations were therefore forced to replace the former arc lights with incandescent lamps, although the latter were at that time not so highly developed as to warrant this replacement on an economic basis. For outdoor illumination the modern arc lamp has no peer, and its efficiency is 0.27 watt per candle, while incandescent lamps require at least double this amount. The construction of a new arc lamp which burns for 120 hours with one pair of carbons, and in which special precaution has been taken to prevent a deposit of ashes on the inside of the glass globe, is described. Homogeneous "effect" carbons are used, which give a yellowish light of great fog-penetrating power. The regulating mechanism is of the differential type, maintaining 42 volts on the lamp terminals. The arc lamp is made for either direct or alternating-current and for 8 amp. to 18 amp., producing 1,300 cp. to 3,300 cp. Since the arc lamp produces twice the amount of light for the same consumption of energy, its operation, including upkeep, carbon exchange and depreciation, is 30 per cent cheaper than that of an equivalent incandescent illumination.—*Elektrotechnische Zeitschrift*, Dec. 9, 1926.

Motors and Control

Starting a Single-Phase Induction Motor.—F. A. LAUPER.—The object of this paper is to analyze some of the various starting arrangements used with single-phase induction motors. These machines have inherently no torque at standstill, but require special devices to produce this torque by altering the motors during the starting period into unsymmetrical polyphase induction motors. It is proposed by the author to deal only with electric starting devices, which have found an extensive commercial application for motors rated from about 1 hp. to 100 hp.

Mechanical means of bringing single-phase induction motors—such as pony motors, etc.—up to speed are not considered in this paper. Inductive devices of either the external or internal type are practically confined in their application to fractional-horse-power machines and are mentioned in the paper only for the sake of completeness.—*Journal of Institution of Electrical Engineers (England)*, January, 1927.

Control of Steel-Mill Auxiliaries.—In this article the relative advantages of alternating and of direct-current drive are contrasted. Details of two typical equipments are given. Direct-acting contactors come in for considerable attention by the author, who analyzes important features of new types as compared with older designs.—*Electrician (England)*, Jan. 7, 1927.

Heat Applications and Material Handling

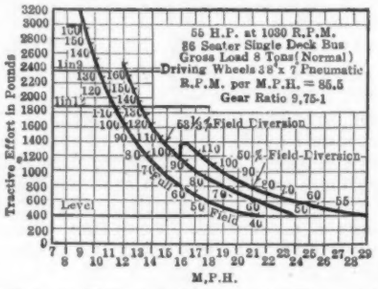
Heat Transfer Through Insulation in the Moderate and High Temperature Fields.—L. B. MCMILLAN.—The author has attempted to outline the state of existing knowledge of heat transference through insulation in the moderate and high temperature fields, pointing out in what respects the knowledge set forth in general literature on the subject is insufficient and that further research is most urgently needed. The paper contains a fund of information, with excerpts from the author's own experience in this field of work. A distinct effort is made to clarify the meaning and the use of the term "conductivity" and to emphasize the importance of a thorough understanding of surface resistance.—*Paper presented at the heat-transfer session of American Society of Mechanical Engineers*, Dec. 7, 1926.

Electric Friction Saw.—U. LOHSE.—For more than 20 years friction saws have given excellent results when cutting steel. The principle of the saw rests on a large, thin steel disk driven at high speed by direct coupling to an electric motor. The edge of the steel disk is roughened by small cross grooves. On pressing the fast-revolving disk against a bar of steel the excessive friction at the point of contact causes such high heat that the metal melts away, producing a surprisingly clean cut. It has so far been impossible to use this method in a satisfactory way to cut cast iron. It was found, however, that to cut cast iron with the same ease as steel, is only a question of properly shaping the edge of the steel disk. The circumference of the cutting disk is interrupted at regular intervals by slots, the total length of the slots being slightly more than the total length of the remaining edge. If care be taken to keep the disk from overheating, 500 to 600 hours of useful life may be obtained from one disk before reconditioning is necessary. The machine is made in three sizes, with motors of 20 hp., 35 hp. and 60 hp. The motors can stand 100 per cent overload for one minute. The medium-size model cuts a 4-in. cast-iron riser in 85 seconds.—*Zeitschrift des Vereines Deutscher Ingenieure*, Dec. 18, 1926.

Advantages of Electric Bake Ovens.—M. P. WHELAN.—In recent years the number of electric ovens used in bakeries in Canada has been increasing so rapidly that the question as to why this has been the case is productive frequently of analyses of such situations. The advantages of the electric oven that enables it to replace fuel-fired ovens are summarized in this article as follows: (1) It is cleaner; there are no smoke, soot, gases, dirty fuel or ashes; the working conditions in the bakeshop are greatly improved, the room being cooler, the air fresher and working equipment cleaner. (2) The products baked are uniform in quality day after day, because accurate temperature control is easily possible and rejection is reduced to a minimum. (3) Floor space required for fuel is eliminated; the electric oven can be installed on any floor, without worrying over the handling of fuel. (4) The air-tight, well-heat-insulated electric oven prevents the unnecessary drying out of foods and so minimizes shrinkage. (5) An electric bake oven, unless used for only a few hours per day, is cheaper to operate than a gas oven, and if all factors are considered will usually be found more economical in operation than any fuel-fired oven of similar capacity. The author proceeds to cite numerous examples bearing on the economic side of the problem.—*Electrical News (Canada)*, Jan. 15, 1927.

Traction

Field-Control Governor for Trolley-Bus Motors.—The early forms of trolley bus were based on tramcar practice and were, in consequence, usually fitted with tramway-type series-wound



CURVES OF TRACTIVE EFFORT VS. SPEED FOR TROLLEY-BUS MOTORS

motors. This type of motor is relatively heavy and has a falling torque characteristic which in practice was found to put the bus at a disadvantage as compared with a gasoline bus, with which it is frequently called upon to compete. Following the outfitting of buses with a single series-wound tramway motor, with rheostatic control, in place of the usual tramcar equipment of two motors with series-parallel control, a further step in the improvement of the motor equipment was the development of a motor weighing about 21 lb. per horsepower. These motors are designed to run at higher speeds than those previously available and thus render it possible to have a wider range of road speed with a full field. In addition, the motors are capable of operating satisfactorily at all loads with 33⅓ per cent of the field current shunted. The article continues to describe the operation and characteristics of the motors and their special applications.—*Engineering (England)*, Jan. 21, 1927.

Telegraphy, Telephony, Radio and Signals

Transmission of Sound Through Voice Tubes.—E. A. ECKHARDT, V. L. CHRISLER, P. P. QUAYLE, M. J. EVANS and EDGAR BUCKINGHAM.—This paper gives the results of an investigation made by the Bureau of Standards of the transmission of sound through voice tubes such as are used on board ship. A good voice tube should transmit speech with as little diminution as possible in intensity and with a minimum of distortion of articulation. Each of these qualities was separately tested, and tables and diagrams and comparisons are given in the paper. Tests were made on straight tubes, curved sweeps, flexible tubes, fittings, elbows and terminal cones. A brief discussion of sound filters is given.—*Technologic Paper No. 333, Bureau of Standards.*

Miscellaneous

Eddy-Current Brake.—F. MOELLER.—On motor-generator sets of the Ilgner or Leonard type, which are equipped with a flywheel, it is customary to provide a brake band or brake shoes to stop the set quickly at the end of the shift or in case of emergency. Such mechanical brakes have many disadvantages, the greatest of which is the unavoidable wear of both the wheel and the shoes. A very effective braking method is afforded by placing from three to five magnet poles on diametrically opposite sides of the flywheel, with but a small air gap between poles and wheel. With direct-current excitation on the pole windings, heavy eddy currents are caused in the wheel, which bring it to a quick stop. For example, a flywheel 14 ft. in diameter, running at 590 r.p.m., requires one and a half hours to come to a stop, while an eddy brake brings the wheel to rest within four and one-half minutes. The mechanical energy of the momentum of the wheel is transformed into heat. Directions are given in the paper as to how to design such brakes in order to keep the developed heat within harmless limits.—*Siemens Zeitschrift*, December, 1926.

Electrical Equipment of a Marine Pier.—A. D. WILDER.—In this article there is given an account of the special electrical equipment provided on the pier "B-C" which the Canadian Pacific Railway has but recently completed at Vancouver as an important addition to its Western terminals. The pier itself is 1,100 ft. long and 331 ft. wide and carries a headhouse at its shore end and two single-deck sheds and eight lines of railroad track running the whole length of the structure to an end house. The system of eight marine elevators, three on each side and two on the outboard end, is operated electrically. In addition to these elevators there are two 10-ton baggage elevators connecting the deck of the pier with the baggage room on the upper floor of the headhouse. On the viaduct between piers "B-C" and "D" there is also installed one 20-ton elevator with a 12-ft. x 35-ft. platform. The article proceeds to describe the use of electricity for such general services as interior and exterior illumination and floodlighting of the pier.—*Electrical News (Canada)*, Jan. 15, 1927.

News of the Industry

Monroe and Freeman Speak

Addresses on Electrical Progress and Opportunities Mark Opening of Midwest Power Conference

WELCOMING delegates to the second Midwest Power Conference, which opened in Chicago Tuesday, Feb. 15, Mayor Dever put a little "reverse English" on the public relations idea by stating that it was profitable for the city to maintain friendly contact with its utilities and other large business interests.

The opening address of the chairman of the conference, W. S. Monroe, president of Sargent & Lundy, gave valuable information on the present and future power situation in the Chicago district. The present 66,000-volt cable installations are the forerunners of a widespread system of 132,000-volt transmission lines, the first link of which will be a cable line of that capacity between Northwest station and Evanston. This cable is now on order. Within the next few years, the speaker said, Chicago will be encircled by 132-kv. lines and a superdistribution system will be developed in the city with 66-kv. "supersubstations."

The second address of the afternoon was given by W. W. Freeman, president Union Gas & Electric Company, Cincinnati. He quoted data from the ELECTRICAL WORLD and other sources on the industry capitalization. In the United States, Mr. Freeman said, only 50 per cent of the houses are anywhere nearly adequately wired, and the total cost to bring all of them to the "red seal" standard would be more than seventeen billion dollars. This condition, combined with only 44 per cent of industrial electric saturation and with the intelligent development and exploitation of industrial lighting and heating loads, spread before the central-station companies a field for future development which the speaker declared to be virtually limitless.

Two hundred and fifty exhibitors combined to make a successful and impressive power show in connection with the conference.

A 50,000-Kw. Generator for Insull Plant at Pekin, Ill.

Preliminary work is now in progress on the site of the superplant eventually to be erected at Pekin, Ill., for the Insull interests, to supply energy to the Chicago metropolitan district. Although plans for the project are not yet definitely determined, a 50,000-kw. turbo-generator has been ordered, and it is now contemplated that the construction will proceed in plant units of 300,000 kw., housing six machines of the size now on order. The plant will be tied into the 132,000-volt transmission system of the Chicago district. The site of the station is on a railroad that taps the coal fields of central Illinois, and it is proposed to develop a coal-storage center in connection with the plant so that coal can be carried by barge to the Chicago stations when the Illinois River canal is completed. Pekin is about 150 miles from Chicago and is on the Illinois River south of Peoria.

Mercury Unit for South Meadow

The success of the pioneer mercury boiler and turbine unit installed by the General Electric Company at the Dutch Point station of the Hartford (Conn.) Electric Light Company has led to a decision by the management of this utility to adopt this type of equipment in the forthcoming enlargement of its modern steam generating plant at South Meadow. No particulars are as yet available concerning the rating and B.t.u. efficiency of the equipment to be built for the South Meadow station, but the apparatus will be of a size to co-ordinate effectively with the units already in service at that station and will be far in excess of the experimental installation made at Dutch Point.

Southern California Edison Camp Hit by Storm

Ten men are known to be dead and twenty-one are injured as the result of a snowslide which struck construction camp No. 72 of the Southern California Edison Company at Big Creek, 75 miles east of Los Angeles, on Feb. 15. The first of the slides occurred at about 2 o'clock in the morning, when two bunkhouses, occupied by sleeping men, and the recreation hall crumbled beneath the weight of tons of snow and dirt which fell from the hill adjoining the buildings. At least nine men are believed to have lost their lives in the first slide. The second slide came at about 7 o'clock in the morning, engulfing in its path a party of rescue workers recruited from the survivors at the camp, and added one to the death roll.

Camp No. 72, occupied by the men working on the Huntington-Pitman-Shaver project of the Edison company, was established a little more than a year ago and was placed on a ridge where it was believed to be immune from such disasters. Although ravines on either side of the ridge bore evidence of former slides, officials pointed out that the ridge bore its virgin timber and it was selected for the camp because of that fact. The storm of which the snowslide was an incident lasted more than six days and was more severe than any ever experienced by the Edison company since it began the Big Creek project in 1912. It is, in fact, declared to have been the most violent storm ever experienced on the Pacific Coast.

New Shoals Commission?

Senate Committee Wants One—Utah and Boulder Dam—Speaker Longworth for Vote on Swing Bill

BY PAUL WOOTON
Washington Correspondent of the ELECTRICAL WORLD

ANOTHER Muscle Shoals commission has been recommended by the Senate committee on agriculture. It would be composed of five Senators and five Representatives-elect, who would study the question and report at the opening of the first regular session of the new Congress, which will convene Dec. 5.

In view of the failure of previous commissions to impress Congress, it is felt by many members that any investigation to be made during the interim between the adjournment of the present Congress and the opening of the next should be divorced as far as possible from politics and should provide for technical advice. There is support for a plan whereby the Secretaries of War, Agriculture and Commerce are to be ex-officio members of any commission that may be selected. This would make available the services of the technical men attached to these departments, who are thoroughly familiar with the various phases of the Muscle Shoals situation.

There is objection to the renewing of the declaration, first made ten years ago, that the nitrate properties of Muscle Shoals could be utilized in time of war in the making of munitions and in peace for the manufacture of fertilizer. Conditions have changed greatly in the last ten years, and ordnance officials believe it would be more advantageous for their purposes in time of war to obtain nitrogen from other sources. There is reason to believe that commercial fertilizer can be manufactured to better advantage, under present conditions, at points other than at Muscle Shoals. For that reason there is a desire that any further investigation that is made shall be free from restrictions and that full opportunity be given for the use of the technical skill in the government service.

There is every determination on the part of Senators and Representatives from certain of the nearby states that consideration be given the distribution of the power over the widest possible area. There is no objection to giving fertilizer manufacture first call on power, but there is strenuous objection to any plan for the local use of any large proportion of the power. Some feel that the Senate committee on agriculture and the House committee on military affairs each should have only one representative on the commission. The controversies which have raged in those committees on this subject are likely to interfere with entire open-mindedness in any further study that may be made.

Government operation of Muscle

Shoals for the purpose of producing fertilizer and explosives is proposed in a joint resolution introduced in the House by Representative Miles C. Allgood of Alabama. Under the resolution the President would be authorized to put Nitrate Plant No. 2 into operation, as well as to make use of any or all Wilson Dam power, for the manufacture of fertilizers and explosives, and to sell whatever power might remain to any distributing company.

Acceptance of the offer of the associated Southern power companies is being urged editorially by the Washington *Post*, which has considerable influence among the legislators at the Capitol.

BOULDER DAM DELAY

Another effort to obtain action on the Boulder Dam project was made in the House on Feb. 12, when Representative Colton of Utah presented a resolution to provide for the utilization of water for the benefit of the states of the upper Colorado River basin. This resolution provides that surveys, plans and estimates shall be made for the irrigation of such lands in the seven upper and lower basin States as may be susceptible of irrigation from the Colorado River system. The work would be carried out by the Bureau of Reclamation, and $175,000 is appropriated for this purpose by the terms of the resolution.

Chairman Smith of the House irrigation committee, which reported the Swing-Johnson bill, blames Utah for the delay in bringing it to a vote. He has, however, received a letter from Governor Dern of that state which seems to intimate that Utah might withdraw its opposition to the bill if the Colton resolution is also passed. Speaker Longworth has declared his conviction that the measure should have its day in court and ought to be considered before Congress adjourns.

Arizona Has New Proposal on Colorado River

Arizona delegates to the tri-state conference on the problem of developing the Colorado River, which reconvened in Los Angeles on Feb. 7, have offered a substitute proposal modifying the original form of plans for allocation of the water and of power royalties to be derived from the river. Details of the new Arizona proposal are being guarded carefully, and official statements issued by the spokesman for the conference, Charles P. Squires of Nevada, contain no information calculated to disclose its character.

It is known, however, that the Arizona tender is predicated upon three general propositions. These are: First, division of the waters among the three states participating in the conference (Arizona, Nevada and California); second, determination of the amount of revenue to be derived by Arizona and Nevada by way of tax or royalty, whether the power development is to be a federal project or a private enterprise; third, settlement of the "rights" of the United States and Mexico in the waters of the Colorado River. This virtually amounts to a proposal to form a new three-state compact.

Edison Pioneers Celebrate

Eightieth Birthday of Inventor Marked by Luncheon at Which He Is the Guest—President's Greeting

AFTER Thomas A. Edison on his eightieth birthday had good-naturedly written replies to scores of reportorial questions on topics ranging from eschatology to politics and from metaphysics to the radio, he attended on Feb. 11 the birthday luncheon given in his honor by the Edison Pioneers. This dinner was held at the Hotel Robert Treat in Newark. In the absence of George F. Morrison, president of the Pioneers, who is ill in Arizona, Mr. Edison's secretary and the historian of the club, William H. Meadowcroft, took charge of the proceedings. He read a greeting to Edison from President Coolidge, who said:

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EDISON GREETS FORD

"I am very glad to have the opportunity to join with your friends throughout the world in extending hearty congratulations upon your eightieth birthday. To your energy, courage, industry and strong will the world owes a debt of gratitude which it is impossible to compute. Your inventions placing the forces of nature at the service of humankind, have added to our comfort and happiness and are of benefit to all mankind for generations to come. I trust that there are in store for you many more years of health and usefulness."

Other letters from prominent men not connected with the electrical industry were read, as well as one from Mr. Morrison. A poem, "Eighty Roses," written by R. R. Bowker, was read by John W. Lieb. Another poem was read by E. S. Mansfield of the Edison Electric Illuminating Company of Boston.

Samuel Insull spoke briefly on Edison's accomplishments and said he considered it a great honor to have served for nearly half a century in a company bearing the name of Edison.

After the luncheon Mr. and Mrs. Edison gave a reception at their home to the Pioneers and other friends. Mr. Edison took the whole day off and was late to work next morning.

Those present at the luncheon included the seven living former presidents of the Edison Pioneers—John W. Lieb, William J. Hammer, Frederick A. Scheffler, Samuel Insull, John W. Howell, Charles L. Edgar and Charles L. Clarke—and the following members, all of whom were associated with Edison or connected with his work prior to 1886:

Adams, Edward D.	Meadowcroft, W. H.
Atkins, William H.	Mott, Samuel D.
Barfoot, Charles G.	Mungle, Alexander
Benton, C. A.	McCoy, Joseph F.
Brock, William M.	MacQuesten, W. D.
Campbell, H. A.	Ott, Frederick P.
Campbell, John R.	Paine, Sidney B.
Carter, Robert A.	Parsell, Henry V. A.
Dwyer, John	Philips, Eugene H.
Estabrook, C. E.	Potter, Frederick D.
Francis, William H.	Schroeder, J. W.
Jehl, Francis	Seymour, J. N., Jr.
Kiddle, Alfred W.	Simmen, Charles A.
King, Charles G. Y.	Skehan, Eugene A.
Lemp, Hermann	Wardlaw, Frank A.
MacLean, H. A.	Williams, Arthur.

Present also were the wives and descendants of many members and the following associate members, the latter having been associated with Edison or connected with his work at some time in the period from Jan. 1, 1886, to Jan. 1, 1900:

Babson, Albert D.	Kimball, F. M.
Barstow, William S.	Kinnicutt, F. H.
Beran, Theodore	Mansfield, Edward S.
Bliss, Louis D.	McGrath, Synan M.
Burke, James	Miller, Harry F.
Burnett, Douglass	Miller, John V.
Chapman, Cloyd M.	Moore, D. McFarlan
Darlington, David	O'Brien, John H.
Dempsey, William T.	Petit, Albert O.
Durand, Nelson C.	Rogers, Henry B.
Ford, Henry	Warren, Aldred K.
Freeman, W. W.	Weller, Harry W.
Gardner, Charles S.	Whitehead, S. N.
Garland, N. M.	Whitestone, S. L.
Holme, A. L.	Wilson, F. P.
Johnson, Walter H.	Wilson, C. H.
Junkersfeld, Peter	

Pennsylvania Railroad Talks of a Future Power Plant

An announcement made at Philadelphia by the Pennsylvania Railroad on Feb. 10 said that conferences had been held between the officials of the Pennsylvania Railroad, Philadelphia Electric Company, Philadelphia Rapid Transit Company, Public Service Corporation of New Jersey, Philadelphia Suburban Gas & Electric Company and Counties Gas & Electric Company (the latter two being subsidiaries of the United Gas Improvement Company) looking toward the construction of a power plant of sufficient capacity to provide for the rapidly increasing needs of these properties, especially for 25-cycle energy. The announcement concluded: "The matter is, however, in purely a formative state and no final decision has been reached."

In printing this announcement the newspapers said that the site of the plant would probably be on the Delaware River near Trenton, N. J.; that it would cost about $10,000,000, and that the power generated would be applied in extending the electrification of the Pennsylvania Railroad. Contradictory reports concerning the conferences, however, at once followed, the Philadelphia Electric Company and the Philadelphia Rapid Transit Company denying that they had taken part in such negotiations. Arthur W. Thompson, president of the United Gas Improvement Company, is quoted as saying that he had understood the report as given out by the railroad to be correct and as expressing his approval of co-operation by the companies concerned in the manner

foreshadowed by the Pennsylvania's statement.

The Philadelphia Electric Company, from which the Pennsylvania Railroad now purchases energy, has great resources for expansion in its new Port Richmond plant and the hydro-electric plant being built at Conowingo, Md. A five-year contract between the Philadelphia Electric and the Philadelphia Rapid Transit for the supply of power to the latter will expire in the spring.

Bay State Utility Companies Unscathed

Governor Fuller Sends Another Letter to 27 of Them Requesting that They Follow Example of 26 Which Have Reduced Rates—Comparison with City Plants

POLITICAL attacks upon Massachusetts utility rates during the past week have continued to fall flat from the standpoint of arousing public disquiet, and security prices show little evidence of alarm on the part of investors. At the week end Governor Fuller addressed a letter to the Department of Public Utilities warning the commission "to be gun-shy of any consideration that has to do with the revaluation of the properties of public utility companies along the line of their replacement value" and declaring his belief that such a revaluation scheme would be "robbing the public." The Governor announced his suspicions of holding-company activities and arraigned the utilities as monopolistic taskmasters. Meanwhile the commission has been going about its duties as usual, and on Monday the board made a report to the Legislature recommending that authority be granted it to regulate the entire rate structures of private companies, instead of the maximum rate, and stating that it is of the opinion that in some cases rate reductions can be made to advantage by the operating companies. The commission declared against any grant to it of powers of regulation over municipal-plant rates on the ground that these rates are already determined by law with power of appeal to the courts.

On Feb. 12 the Governor addressed another letter to 27 companies, saying:

> I am writing to you again—possibly this is the last letter on the subject—in the hope that your company will voluntarily make a reduction in rates. Since I initiated my inquiry to the Public Utilities Commission as to the profits of the companies, 26 Massachusetts companies have voluntarily reduced their rates. I think they were very wise in doing so. I think it was good business. And so I want to ask you if you do not think it would be a proud boast in future years for you to say—and have it written into the records of your company if you please—that in 1927, when the Governor asked the electric light companies, in view of the reduced cost of making electricity, to reduce their rates, your company did so voluntarily before the Public Utilities Commission was given the authority to initiate hearings and order the reduction of rates if conditions justified it.
>
> I cannot get away from the fact that the public are entitled, on the basis of the sworn returns of certain companies, including your own, to have a reduction in rates. I sincerely believe that the twenty-six companies that have already reduced their rates have been wise in so doing, and I write and ask you if you propose to follow their example, or is your answer "no"? I hope it is "yes."

The following are the light and power companies which have reduced their rates since Governor Fuller initiated his inquiry (the gas companies included having electric departments): Worcester Suburban Electric Company, Northampton Electric Lighting Company, Leominster Electric Light & Power Company, Williamstown Gas Company, Union Light & Power Company of Franklin, Adams Gas Light Company, Ayer Electric Light Company, Clinton Gas Light Company, Mill River Electric Light Company, North Adams Gas Light Company, Spencer Gas Company, Southeastern Massachusetts Power & Light Company, Weymouth Light & Power Company, Winchendon Electric Light & Power Company, Randolph & Holbrook Electric Light Company, Citizens' Gas, Electric & Power Company of Nantucket and Pittsfield Electric Company. The municipal light departments of Belmont, Georgetown, Hingham, Hudson, Hull, Ipswich, Merrimac, South Hadley and Wellesley have also reduced rates.

Replying to Governor Fuller, President Walter L. Mulligan of the United Electric Light Company of Springfield said that after careful consideration the directors of that company had previously voted to grant on December bills a discount of 25 per cent to apply to all classes of customers; that this discount is now being paid and will amount to more than $100,000, but that since this method of reducing rates does not seem to be understood by the press, public or legislative bodies, the company is now confronted by conditions which may require it to consider some other method. "We are informed," Mr. Mulligan adds, "that the Department of Public Utilities is to make an investigation and report covering the whole situation. Until we are advised of legislation enacted affecting methods of regulating the electric light business, it seems unwise to predict what rearrangements of rates can be made."

Last week an important hearing was held by the legislative committee on power and light, at which Sheldon E. Wardwell, counsel for the Massachusetts Gas and Electric Association, attacked a bill permitting cities and towns to embark in municipal ownership undertakings without the usual deliberative procedure. The proposed act would allow a city council by a majority vote to enter the municipal lighting business on one day's notice instead of having to vote in two consecutive years as at present. Data were presented by Mr. Wardwell to show that in 1925 many private companies sold energy at an average price of 1 cent per kilowatt-hour less than did the municipal plants of the state and that in addition the former paid $12,000,000 in taxes. In some cases the private companies pay almost as much in taxes as they do to their stockholders. The following table compares the maximum prices of electricity in four leading private companies with those in effect in four typical municipal plants, prorating the taxes per kilowatt-hour in proportion to the relative lighting and power revenues of each company:

Private Company	Per Kw.-Hr. Sold, Cents: Rate	Taxes	Net Rate	Municipal Plant	Per Kw.-Hr. Sold, Cents
Malden	9.0	1.73	7.27	Wakefield	7.5
Springfield	8.0	3.45	4.55	Holyoke	5.0
Worcester	7.0	2.99	4.01	Chicopee	6.5
Boston Edison	8.5	2.84	5.66	Wellesley	7.3

Michigan Interconnection

Detroit Edison and Consumers Power Will Connect Their Lines by Building 60-Mile, 132-Kv. Line

MICHIGAN'S first big electrical interconnection project, a 60-mile, 132-kv. line tying together the two transmission systems of the Detroit Edison and the Consumers Power Company, has been announced by A. C. Marshall of the Edison organization and C. W. Tippy of the Consumers Power. Rights-of-way have been obtained for the new line, plans worked out for substation equipment and work will be begun at once. It is announced that the interconnection will be completed some time during the current year. Under the joint plans agreed upon each company will erect suitable substations at terminals of the new line, and a new company, to be known as Electrical Interconnections, Inc., has been organized which will build, own and operate a section of the line, 24 miles in length, from Saline Township to Cement City. This company will have executive officers from the Detroit Edison and Consumers organizations, with Alex Dow, president Detroit Edison, as president, and B. C. Cobb, president Consumers Power Company, as senior vice-president.

This line will tie together two systems with an installed generating capacity of 342,000 hp. for the Consumers and 852,000 hp. for the Edison. About 50 per cent of the Consumers capacity is hydro-electric, and during certain periods of the year the Edison company will utilize the Consumers' excess energy from hydro plants with resultant economies and fuel conservation. The connected capacity of the Detroit Edison will be available in event of emergency requirements to stabilize service on the Consumers system.

The Detroit Edison Company will construct a substation at Superior, near Ypsilanti, and install therein three 15,000-kva., 120,000/140,000-volt transformers. From this substation the Detroit Edison will build a steel-tower transmission line to the town line between Saline and Bridgewater Townships, a distance of approximately 18 miles, on a private right-of-way. This tower line will be constructed to handle two three-phase No. 0000 copper transmission circuits, only one of which will be erected at the present time.

From Cement City to Jackson the transmission line, similar in all respects, will be owned and constructed by the Consumers Power Company. This company plans to construct a steel

outdoor substation north of the present city limits of Jackson and will install therein three 10,000-kva. transformers, with a voltage of 140,000/120,000. This substation will also be the terminus of 140,000-volt lines from the north and west which form the Consumers Power Company's main system. Bulk electricity will be distributed from it.

In the Legislative Mill

Bill to Abolish Commission Goes to Third Reading in Indiana Senate—For New England Power Treaty

THE Moorehead Senate bill in the Indiana Legislature, which among other things provides for the election of members of the Public Service Commission, has been reported favorably by the committee. The Cann Senate bill to abolish the commission entirely was sent to third reading without debate. These two bills are regarded as the most important measures affecting utility regulation now pending. The Shake bill, referred to last week, was defeated. An amendment made to the Moorehead bill in committee provides for the appraisal by the commission of utility property at its present "fair value," instead of its present "market value."

Two bills have been introduced in the New York State Senate designed to further recommendations of the Public Service Commission. The Brereton bill gives the commission jurisdiction over "a corporation or person controlling through lease, voting trustees or operating contract a corporation subject to jurisdiction of commission, or which furnishes products or service to such corporation for ultimate distribution to the public." This measure would apparently give the commission supervision over holding companies. The Mastick bill brings under law "persons or corporations selling, distributing, furnishing or reselling through private meters electricity generated or sold by any other person or corporation."

A bill providing for the creation of a joint commission to negotiate a power treaty between Maine, New Hampshire and Massachusetts, and possibly the three other New England States, has been introduced into the Maine Legislature by Senator Oakes of Cumberland. The measure seeks to have Maine take the initiative in asking the consent of Congress to such a treaty and, according to the author, is designed to cover comprehensively the whole subject of conservation, development of water-power resources, transmission and distribution of electricity.

Municipalities in Maryland would have the power to sell or otherwise dispose of electric or gas plants owned by them to any electrical or gas corporation, subject to approval of the Public Service Commission, under a bill introduced in the Legislature by Senator Beck. The bill provides that such sale or disposition must be ratified by the voters of the municipality if 10 per cent of the voters request it within thirty days after intent to sell is published. At present a special act of the Legislature is required to authorize the sale of a municipal plant. The House of Delegates has rejected the Berman motion to investigate Conowingo (referred to last week) by a vote of 80 to 31.

A bill to license engineers is pending in the Oregon Legislature. A similar bill has been indefinitely postponed in the Nebraska Legislature.

Oswego Approves Lease of Its Water Power to Carlisles

Indorsement of the Carlisle plan to lease the water power at Dam No. 6 in the Oswego River from the city of Oswego, N. Y., was assured by the special election held there on Feb. 10, when the leasing proposal was carried by a vote of 6,959 to 1,111. The offer made the city by the Carlisle interests for a 25-year lease of the power calls for the building of a modern power house, which will cost in the neighborhood of $850,000; the payment of annual rentals of $50,000 a year, the elimination of the service charge of 50 cents per month paid by every user of electricity, and the return of the plant to the city at the end of the leasing period in good mechanical condition. The energy will be used to augment that generated by the Oswego River Power Corporation.

Supply Jobbers to Convene at White Sulphur May 2

Announcement has just been made that the Electrical Supply Jobbers' Association will hold its summer convention in the week of May 2 at the Greenbrier Hotel, White Sulphur Springs, W. Va. This action ends a discussion as to whether or not to go to the Pacific Coast this year for the meeting.

Deadlock on New York Hydro Plans May Be Averted

Although Governor Smith and the Republican leaders in the New York Legislature conferred this week in an effort to settle their differences on water-power legislation, it is far from certain that another deadlock can be averted. It was indicated that the Republicans virtually informed the Governor of their unwillingness to pass his Power Authority proposal, but instead expressed themselves as agreeable to the formation of a water power commission to be composed of two men named by the Governor, two from the Legislature, representing each house, and a fifth to be elected by the four thus chosen.

Assemblyman Willis H. Sargent of Syracuse, who introduced a water power commission bill early in the session, has incorporated in it the names of suggested members, these being Secretary Hoover, former Governor Hughes, General Goethals, former Judge Hiscock and Charles E. Treman of Ithaca. While some or all of these names are acceptable to the Governor, it is not thought that he will consent to this bill, which denies any recognition to his Water Power Authority plan. Senator John Knight and Attorney-General Ottinger condemned that plan in public addresses at Utica on Lincoln's Birthday.

Details of Denver Fight

Franchise Finds Adverse Majority in Only One Precinct Out of 293—Company Announces Plans

BY A MAJORITY of two and a half to one, as reported last week, the voters of Denver on Feb. 8 registered their approval of the twenty-year franchise submitted by the Public Service Company of Colorado, the Cities Service (Doherty) subsidiary operating the gas and electric utilities in the capital city of Colorado. While the total vote cast was comparatively light, the franchise received substantial majorities in all but two of the 293 voting precincts, these majorities in some precincts running as high as ten and twelve to one. One precinct returned a majority of thirteen votes against the franchise, while in another the vote was a tie.

The election marked the successful culmination of the company's efforts to renew its Denver franchise. In May, 1925, one year prior to the expiration of the then existing contract with the city, the voters rejected the utility's franchise proposal by approximately the same majority as was recorded in favor of the latest agreement. The campaign in support of the new franchise, which becomes effective immediately, was characterized by the indorsement of city officials, including the Mayor, the City Attorney and the Denver Council, of civic leaders and numerous organizations, and by favorable news and editorial comment in the Denver press. Daily newspapers of Denver without exception, urged the approval of the franchise, and the weekly press with a single exception favored the proposal.

Conspicuous among the provisions of the new franchise is an electric rate revision which will benefit customers by approximately $675,000 annually. Other provisions include the payment of an annual franchise tax to the city of $60,000 a year, agreement to purchase hydro-electric power from the city at a rate to be determined by a board of competent engineers should the municipality ever develop a plant in connection with its water supply source, and purchase by the company of an underground wiring system owned by the city.

Immediately after the outcome of the election became known, Clare N. Stannard, vice-president and general manager, confirmed a previous announcement that the Public Service company contemplated an expansion program involving the expenditure of $40,000,000 during the next few years, of which part pertains to the gas division. Addition of a fourth generating unit and more boiler equipment is planned for the Valmont power plant, north of Denver, at an estimated cost of $700,000. Construction of a new warehouse and service building in Denver, costing $500,000, will be started at once. About $450,000 will be spent on the extension of electric distributing systems and gas mains. In addition, a general program of construction and maintenance which has been delayed by the franchise negotiations will be undertaken immediately.

Purchases and Mergers

Delayed Indiana Consolidation Nears Completion—McGraw Acquires Dakota Public Service

DETAILS of the merger of the Terre Haute, Indianapolis & Eastern Traction Company and its subsidiary companies with the Central Indiana Power Company, which has been pending for about a year, rapidly are approaching completion, according to a statement of officers. The two utilities are to be merged under the name of the Indiana Electric Corporation and will be operated as one corporation. The Central Indiana Power Company, which is an Insull holding, owned the Merchants' Heat & Light Company of Indianapolis. It is said that the recent merger of the Merchants' Heat & Light Company and the Indianapolis Light & Heat Company as the result of the sale of both properties to Harley L. Clarke of Chicago and his associates caused a delay because the Merchants' company thus was removed from the holdings of the Central Indiana Power Company.

The consolidation is announced of the Platte Valley Power Company, which operates in a number of small east Nebraska towns, with the Dakota Public Service Company of Sioux City, Iowa, which controls fifty utilities in the two Dakotas, and also with the W. N. Albertson Company of Milwaukee, utility engineers and operators. The Central West Public Service Company, of which the McGraw Electric Company owns all the common stock, will be the parent company. Mr. Albertson becomes general manager and president. A. J. Cole of Nebraska, general manager of the McGraw Electric, will be a vice-president. Omaha is to be the central headquarters of the new ten-million-dollar company. The transfer to Omaha is also announced of George W. Kalweit, Milwaukee, vice-president and treasurer. The McGraw company operates ten generating plants, owns 500 miles of transmission lines and has 150 more miles under construction.

The Eastern Texas Electric Company of Delaware, a subsidiary of Engineers' Public Service Company, has purchased the Nebraska Electric Power Company, which serves about 25 towns in central and northwestern Nebraska and maintains generating stations in Loup City, Broken Bow, Cozad, Lexington and Gordon. The Nebraska company will be under the executive management of Stone & Webster, Inc., and will be operated from Scottsbluff, Neb.

Stockholders of the Consolidated Gas, Electric Light & Power Company and the Baltimore Electric Company have voted to transfer the entire property of the latter to the former. Since 1907 the Baltimore Electric Company has been operated under lease by the Consolidated company.

The Trenton (Wis.) Power & Light Company, serving a wide rural area, has been purchased and made a part of the Wisconsin Power & Light Company, from which it has been purchasing power for redistribution.

Negotiations which have been in progress for the purchase of the Manitowoc municipal electric system, one of the largest city-owned utilities remaining in operation in Wisconsin, are off, the Common Council at its last meeting refusing a cash offer of $1,000,000 which was made for the properties by Minek & Olaisurn of Tulsa, Okla.

Voters of Willow Lake, S. D., have approved the sale of the Municipal plant to the Northwestern Public Service Company.

If the Wisconsin Power & Light Company and the City Council of Randolph, Wis., can arrive at a satisfactory price, with the aid of the Wisconsin Railroad Commission, a proposal to sell the city's distribution system to the city will be submitted to the voters in the spring. Randolph now buys its energy from the company.

Last Year an Important One in California Electric Field

That 1926 was an important year in the electric field in California is shown by a report of A. G. Mott, chief engineer of the Railroad Commission, on the activities of the engineering department. Numerous transfers of property were passed upon by the commission, among them being the purchase by the Pacific Gas & Electric Company of the Lake County Water & Power Company and the Bell Electric Company and the purchase by the Great Western Power Company of the Napa Valley Electric Company.

Rate proceedings involved the valuation and adjustment of rates of the Southern Sierras Power Company and the revision of rates in the San Francisco Bay cities. The former were ended, the other proceedings being still in progress. The revision of rules for overhead electric line construction, a matter of extreme importance to all electric utilities in California, has been virtually completed, and the rules will soon be available in printed form. The work of inspecting these lines for defective, faulty and illegal construction has already resulted in elimination of 300,000 potential causes of accident or interference.

Important valuation work gave these approximate values: Pacific Gas & Electric Company, San Francisco, $25,000,000; Great Western Power Company, San Francisco, $10,000,000; Southern California Edison Company, distribution system in annexed territory, Los Angeles, $900,000; Southern Sierras Power Company, $20,000,000.

Southeastern Sales Conference at Atlanta Arouses Enthusiasm

MORE than 65 delegates from central-station and manufacturing companies attended a sales conference conducted by the Commercial Section of the Southeastern Division, N.E.L.A., in Atlanta on Feb. 9. Several of the committees had an attendance of 100 per cent. In opening the conference A. B. Collins of the Alabama Power Company, chairman of the section, said that the merchandising activities of central-station companies should set the pace for all other departments and that through intelligent sales effort sales should be doubled, tripled and quadrupled. He stressed the point that light and power companies are not displaying merchandise to the best advantage, particularly as regards lamps and small accessories.

M. G. Williams of the Matthews Electric Company, Birmingham, spoke on the co-ordination for selling purposes of jobbers, central stations and contractor-dealers, saying that the jobber can accomplish much to bring this about. M. C. Morrow of the Westinghouse company then referred to the work being done by the National Range Manufacturers' Association. Following this the various committee chairmen outlined their work in preparation of reports to be presented at the Memphis convention of the division. These reports will be complete and valuable.

An inspection trip was made through the lighting institute that has been set up in Atlanta by the Edison Lamp Company. Following the banquet in the evening addresses by B. C. Edgar of the Tennessee Electric Power Company, president of the Southeastern Section, and P. S. Arkwright, president of the Georgia Power Company, aroused enthusiasm.

Water-Power Topics in Canada

Chairman Magrath of the Ontario Hydro Commission Gives Figures for Growth in 1926—Political Dispute Over the Carillon Site on Ottawa River

A RECENT report sponsored by C. A. Magrath, chairman of the Hydro-Electric Power Commission of Ontario, puts the annual growth in the load on the provincial system at from 80,000 hp. to 100,000 hp. Last year, he says, the commission's estimate of 730,000 hp. as the necessary output was more than realized, and hence, fearing a shortage and knowing that power from the Ottawa River could economically be transmitted more than 200 miles, the commission made its bargain with the Gatineau Power Company for electrical energy from the plants which this subsidiary of the International Paper Company is building. The terms, Mr. Magrath says, have made the building by the commission of a high-tension line from Ottawa to Toronto an economically feasible project.

The report, however, goes on to say that "the commission still looks forward to St. Lawrence power as the principal source from which to meet the heavy future needs of Ontario municipalities. The commission is continuing its own investigation on the St. Lawrence, and no factor that is germane to the consideration of this problem, so far as the commission can deal with it, is being overlooked. The commission hopes that debatable features incident to the problem will soon reach a solution." The statement says further:

"With regard to the financial status of the commission and of the associated municipal electrical utilities, it must be remembered that the fiscal year of the local hydro utilities closes on Dec. 31 and the compilation of the extensive statistics involved does not become available until later in this year. In 1925 the total capital investment of the Hydro-Electric Power Commission in the undertaking under its immediate jurisdiction was approximately $199,000,000. In 1926 the corresponding total was $204,000,000, showing an increase of about $5,000,000. The total investment of the municipalities in connection with their local hydro utilities now aggregates about $81,000,000, so that the total investment of the commission and the municipalities in the whole undertaking is about $285,000,000."

Dispute Over the Ottawa

Political controversy in Canadian power circles over the right of the Georgian Bay Canal Company to have a hand in the development of the Carillon water-power site on the Ottawa River has waxed warm. Recently C. A. Maguire, a member of the Ontario Hydro-Electric Power Commission, launched a vigorous attack against the Georgian Bay Company, charging it with being interested only in power development on the Ottawa River and not being concerned with navigation or the ultimate construction of the canal, these being the ostensible objects for which it obtained a Dominion Charter 30 years ago.

Taunted by the promoters of the canal on the ground that the Ontario Hydro-Electric Power Commission was associating itself with the Quebec "power trust," Commissioner Maguire said:

"Of private interests the ones most immediately concerned in the present controversy are the Montreal, Ottawa & Georgian Bay Canal Company and the National Hydro-Electric Company of Montreal. The National Hydro-Electric Company holds from the federal government a license purporting to authorize the development of water power in what is known as the Carillon section of the Ottawa River.

"The Province of Quebec has been jealous of its water-power rights on provincial streams, and as to half of the interprovincial section of the Ottawa River it controls the privilege of using for power purposes the surplus over navigation needs, and may grant the privilege on terms or withhold it. The other half of the water power of the interprovincial section of the Ottawa River is similarly owned by the Province of Ontario, and the government of the province has delegated to the Hydro-Electric Power Commission the duty of developing these powers as needed in the interests of the people of the province. It cannot be admitted that the federal government has any right to alienate Ontario's water powers on the Ottawa."

Definite assurance that the whole question of power development on the Ottawa River will be dealt with by the Canadian Parliament during the present session is given by the tabling of an order-in-council extending the life of a lease issued to the National Hydro-Electric Company in 1913 and expiring May 1. The charter issued 33 years ago to the Montreal, Ottawa & Georgian Bay Canal Company also expires at the beginning of May. Parliament is expected to decide once and for all who is to have the right and privilege of developing the important power site at Carillon.

Metermen of Three States Gather at Huntington

One hundred representatives of meter departments of electric light and power companies in West Virginia, Kentucky and Ohio met at Huntington, W. Va., on Feb. 9 and 10, when the meter committee of the East Central Geographic Division, N.E.L.A., held open sessions in that city at the Hotel Prichard. W. R. Power, manager Appalachian Power Company at Huntington, welcomed the delegates and R. C. Fryer responded. The meeting was to have been addressed by former Governor E. F. Morgan, but he found it impossible to be present. A. A. Hall, professor of electrical engineering at the West Virginia University, Morgantown, made an address, and L. C. Nicholson of the Niagara Electric Improvement Corporation spoke on "Theory and Design of Air-Core Transformers." The economics of single-phase meter testing was discussed at a round-table conference.

Others on the program were A. Bliss McCrum, secretary West Virginia Association of Public Utilities; J. P. Pope, president East Central Division, N.E.L.A.; W. H. Dickinson, General Electric Company; Gould Ellis, Appalachian Electric Power Company; E. D. Doyle, Leeds & Northrup Company; C. B. Dlauch, Westinghouse Electric & Manufacturing Company, and F. C. Holtz, Sangamo Electric Company. There was a comprehensive manufacturers' display.

Briefer News

Sault Ste. Marie, Ontario, Plans Big Hydro Development.—An organization under the name of the Citizens' Hydro-Electric Committee has been formed at Sault Ste. Marie, Ontario, with the Mayor as chairman. Its purpose is to bring about under public ownership the development of 25,000 hp. on the Montreal River and 100,000 hp. on the Mississauga River. The Ontario Hydro-Electric Power Commission will be asked to take the matter up and furnish estimates.

Old and New Equipment in Sac City, Iowa. — By a decree of the District Court the Iowa Light, Heat & Power Company has been ordered to remove its electrical distributing system from the streets of Sac City, Iowa, at once. A restraining order from the Supreme Court may be asked. The city late in 1924 gave the company eighteen months' notice to vacate, as required by a city ordinance. In the meantime a franchise was granted to the Sac County Electric Company, which built a new plant and equipment.

Searchlamps to Advertise Virginia's Natural Bridge.—"Night tourists" expected throughout the Shenandoah Valley from Northern states during the coming summer will be guided to Virginia's Natural Bridge by high-powered searchlamps pointing skyward from the top of the bridge. At many points on the sides and in the 215 ft. from the top of the bridge to the stream that runs beneath other illuminating devices of great intensity will aid in making this wonder spot as attractive by night as by day.

Conflict Over Appliance Sales in Tacoma.—A new division of sales and equipment organized in the light department of the city of Tacoma, Wash., by Commissioner Ira S. Davisson brought forth a strong protest from electrical dealers and contractors, who declared that the city's prices constituted not merely competition but strangulation. The new city department was organized to further the use of electrical devices in homes and business houses and to sell motors to industrial establishments. Commissioner Davisson declared that the light department went into the range and equipment business years ago at the suggestion of electrical dealers and

that, because of the capital outlay necessary, motors and heavy cooking equipment cannot be handled in sufficient assortment by any private house to meet the demand.

New High-Tension Line for Connecticut.—The Connecticut Electric Service Corporation has approved a plan to build a high-tension transmission link between the systems of the Connecticut Light & Power Company at Meriden and the Eastern Connecticut Power Company at Montville. The line will be 40 miles long and cost $500,000.

Water Power in the Jefferson River Basin, Montana.—The Geological Survey has recently issued as "Water-Supply Paper 580-B" a brief report entitled "Water Power and Irrigation in the Jefferson River Basin, Montana," by J. F. Deeds and W. N. White, which contains a discussion of present and potential water-power and irrigation development in that area, which is the ultimate source of the Missouri and Mississippi Rivers. The report is illustrated by a map of the region showing the location of irrigated and irrigable lands as well as power and reservoir sites.

Northern Maryland Line Completed.—The Northern Maryland Power Company, Elkton, Md., has notified the Maryland Public Service Commission that the company's line from Smith's Chapel to Earlton has been completed and that customers in Aldine, Webster, Earlton and adjacent places are being served. The company requests that an application made to the commission by the Consolidated Gas, Electric Light & Power Company, Baltimore, for permission to build a line over the same route be dismissed.

Conowingo Dam 40 per Cent Complete.—Philadelphia Electric Company officials assert that the fifty-two-million-dollar Conowingo power dam is two months ahead of its construction schedule and is now 40 per cent completed. Progress has been steady despite the fact that there were two floods last year—one in September and the other in November—that broke all records for high water in that territory. Fifty per cent of the excavations of river rock has been completed. It is expected that the first power-house unit will start operation by the middle of next year. About 3,000 men are employed on the undertaking.

E. W. Hodges Talks to New Englanders.—Earl W. Hodges, director of public relations, Henry L. Doherty & Company, New York, addressed 175 members of the New England Division, N.E.L.A., on Feb. 9 at the Copley Plaza Hotel, Boston, outlining the essentials of maintaining good feeling and understanding between utilities and the people whom they serve. S. T. MacQuarrie, director of the New England Bureau of Public Utility Information, Boston, presided after introductory remarks by Past-president F. A. Belden. During the meeting the Massachusetts rate situation was briefly discussed, and the desire of the operating companies to aid the state authorities in getting at the truth regarding earnings and adequate return on a suitable rate base was emphasized. It was the consensus of opinion that the light and power companies in Massachusetts have nothing to fear from a fair and intelligent investigation of their rate schedules and finances.

Regulations for Overhead Electric Lines in Iowa.—George Charlesworth, electrical engineer of the State Board of Railroad Commissioners, was elected chairman at a recent meeting in Des Moines, Iowa, of a general committee composed of representatives of public utilities in the state which was convened to formulate a safety code for overhead electric lines. Five sub-committees were appointed to report respectively on power lines crossing over or under railroad tracks, power lines crossing communication lines, power lines in conflict with communication lines, power lines alone, and joint use of poles by power and communication lines. A sixth committee will work on general rules, definitions, correlating and editing of the code, adopting parts of the National Electrical Code.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 1, page 80.]

Iowa Section, N.E.L.A.—Dubuque, Feb. 24 and 25. H. E. Weeks, Davenport, Iowa.

Oklahoma Utilities Association—Huckins Hotel, Oklahoma City, March 8-10. E. F. McKay, 307 Local Building, Oklahoma City.

Northwest Electric Light and Power Association, Engineering Section—Portland, Ore., March 10 and 11. O. L. LeFever, Northwestern Electric Co., Portland.

American Institute of Electrical Engineers—Southwestern District, Kansas City, March 17-18; Middle Eastern District, Bethlehem, Pa., April 21-23; Northeast District, Pittsfield, Mass., May 25-27. F. L. Hutchinson, 36 West 39th St., New York.

National Electrical Manufacturers' Association, Policies Division.—Briarcliff Manor, N. Y., March 17-18. S. N. Clarkson, 30 East 42d St., New York.

Illinois State Electric Association—St. Nicholas Hotel, Springfield, Ill., March 17 and 18. R. V. Prather, 205 Illinois Mine Workers' Building, Springfield, Ill.

Southeastern Division, N.E.L.A.—Peabody Hotel, Memphis, Tenn., April 13-15. C. M. Kilian, 404 Wynn-Claughton Bldg., Atlanta.

Southwestern Division, N.E.L.A.—New Orleans, April 26-29. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 26-29. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Nebraska Section, N.E.L.A.—Grand Island, Neb., April 27-28. H. M. Davis, 1519 O St., Lincoln.

American Electrochemical Society—Benjamin Franklin Hotel, Philadelphia, April 28-30. Colin G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Cape Girardeau, May 5-7. F. D. Beardslee, 315 North 12th St., St. Louis.

Middle West Division, N.E.L.A.—Topeka, Kan., May 18-20. H. M. Davis, 1519 O St., Lincoln, Neb.

Canadian Electrical Association—Clifton Hotel, Niagara Falls, Ont., May 25-27. J. B. Woodyatt, Southern Canada Power Company, Montreal.

National Electric Light Association—Atlantic City, N. J., June 6-10. Paul S. Clapp, 29 West 39th St., New York.

New York & Queens Company Revises Its Rate Schedules.—The New York & Queens Electric Light & Power Company, operating in Queens Borough, New York City, has announced a reduction in its maximum rate from 9 cents to 8½ cents per kilowatt-hour, effective March 1. In connection with this reduction the company has filed with the Public Service Commission a revised schedule, the salient feature of which is a change in the form of rate from a straight-line, non-inducement form to a block-rate form applicable to general use of light and power. The company will serve as many of its large customers as possible from its secondary mains, and in order to do this a new classification for large users of light and power is included. Primary service will in future be offered only to installations in buildings ordinarily not frequented by the public.

Power Fight in Gainesville, Fla.—Forces of the law have been enlisted by the city of Gainesville, Fla., which owns and operates a power plant, in a fight to prevent the Florida West Coast Ice Company, which is now building a plant there, from obtaining electric power from the high-tension lines of the Florida Power Company. The city plans to charge the ice company with tresspassing should any power lines be run into the plant from the system of the power corporation. City officials declare that they are opposed to permitting the Florida Power Company to gain an "opening wedge" in Gainesville.

Missouri Committee on Public Utility Information Organizes Speakers' Bureau.—The Missouri Committee on Public Utility Information is organizing the State of Missouri into twelve districts for the purpose of training and providing speakers on public utility subjects and otherwise promoting publicity and good public relations. The headquarters of the central bureau will be in St. Louis and will be directed by J. B. Sheridan, secretary of the committee. Districts will consist of one or more countries. They have already been organized around Kirksville, Trenton, St. Joseph, Kansas City, Mexico, Sikeston, Rolla, Springfield and Joplin.

Women's Activities to Play Large Part in Oklahoma Convention.—Women will play a more prominent part in the annual convention of the Oklahoma Utilities Association, to be held at Oklahoma City March 8, 9 and 10, than ever before in the history of the association. A special luncheon and meeting will be attended by about 200 women employees of utility companies. It will be held at the Huckins Hotel March 9 under supervision of the women's public utility information committee of Oklahoma. The general sessions of the convention will be held each morning and division sessions each

afternoon. Among prominent utility men who will speak are H. B. Flowers, president New Orleans Public Service Company; H. O. Caster and Earl W. Hodges of Henry L. Doherty & Company; W. S. Vivian, Chicago; H. S. Bennion, New York; Martin L. Pierce, North Canton, Ohio, and Frank LeR. Blanchard, president Public Utility Advertising Association.

Lorain, Ohio, Has New Company Headquarters.—Formal opening of the new office building of the Ohio Public Service Company at Lorain recently attracted nearly 15,000 persons during the "open house" from noon until 10 p.m. The building is at the corner of Broadway and Eighth Street and occupies a space of 50 ft. fronting on Broadway and 125 ft. on Eighth Street. The present structure, constructed of steel, concrete and tile, is only two stories high, but arrangements have been made for three additional stories when growth of business demands. Almost the entire building is occupied by the company activities.

Gulf Island Plant of Central Maine Company Completed.—Save for a few minor details, the five-million-dollar dam and power house built by the Central Maine Power Company at Gulf Island in Clark's Ripp in the Androscoggin River, of which the first unit was started up in October, is finished. It contains three generators with a total rating of 27,000 hp. The dam is 50 ft. high and 1,800 ft. long, stretching across the river. The power house is on the Lewiston side of the river, with the gates and spillway beyond. Above the dam an artificial lake has been formed which is more than a mile wide in places. The two units just completed have not yet gone into active service.

Engineering Section of Northwest Association to Meet in March.—March 10 and 11 will be the dates and Portland, Ore., the place of the third annual meeting of the Engineering Section of the Northwest Light and Power Association, which forms a geographical division of the N.E.L.A. Men prominent in the industry will speak. On the first day papers under the guidance of the overhead systems committee will deal with tests of insulators, "fire-killed" poles and the standardization of distribution methods. The meter committee will present a paper on polyphase metering, and four practical papers will be sponsored by the hydraulic power committee, dealing with silt deposits, with a device invented by D. W. Pioebstel to determine overbreak in tunnels and the amount of concrete needed for lining, with allocation of water for irrigation, power and domestic use, and with high-head design, special reference being had to rubber-seal rings. Committees that will present papers on the second day include those on accident prevention, apparatus, underground systems, prime movers and inductive co-ordination. Topics comprise telephone interference, transformer oils, overhead lead-covered cable, fitting of lead sheaths on cable, transformer manhole ventilation, modern submarine cable practice, etc.

Men of the Industry

Important Changes Made in Sangamo Organization

R. C. Lanphier Succeeds the Late Mr. Bunn in Presidency—Otis White and F. C. Holtz Named Vice-Presidents

Robert C. Lanphier was elected president of the Sangamo Electric Company, Springfield, Ill., at the annual meeting of the board of directors held Feb. 7, to succeed the late Jacob Bunn, who had been president of the company since its foundation in 1899. Mr. Lanphier started with Mr. Bunn, immediately after his graduation from the Sheffield Scientific School at Yale in

R. C. LANPHIER

1897, to undertake the development of an electric meter on which Mr. Bunn held patents issued to Ludwig Gutmann. After a year of experimental work, Mr. Bunn and Mr. Lanphier organized the Sangamo Electric Company early in 1899. For several years Mr. Lanphier was superintendent and chief engineer, later secretary and general manager, and during the past ten years vice-president and general manager. Mr. Lanphier is also president of the Sangamo Electric Company of Canada, Ltd., and a director of the British-Sangamo Company, Ltd., the affiliated Sangamo companies in Canada and England. He is also vice-president of the Monarch Tractors Company of Springfield.

Mr. Lanphier is a fellow of the American Institute of Electrical Engineers and a director of the Society for Electrical Development. He is also chairman of the Council of Social Agencies of Springfield, embracing the various welfare activities of that city, and has been for a number of years chairman of the Sangamon County Red Cross Chapter. He is a member of the Yale and Engineers' Clubs, New York, the University Club, Chicago, and the Sangamo and Illini Clubs of Springfield. Mr. Lanphier has long been an enthusiastic and ardent worker for the good of the electrical industry, and his many friends congratulate him on his well-deserved promotion.

Otis White, who has been affiliated with the Sangamo organization since the beginnings of the company, in charge of all mechanical development, has been named vice-president in charge of manufacturing. For a number of years Mr. White has been general superintendent of the company, and he will continue in the same capacity but with the new title.

Fred C. Holtz, who has been identified with the company since January, 1919, as chief engineer, has been named vice-president in charge of engineering. During his association with the Sangamo company Mr. Holtz has developed much important work, including the organization of the research laboratory, the invention of the Sangamo clock, etc. A graduate of the University of Nebraska, he was formerly connected with the General Electric Company, being associated during part of that time with Dr. Steinmetz.

R. B. Feagin Elected a Vice-President of Electric Bond & Share

Ralph B. Feagin has been elected a vice-president of the Electric Bond & Share Company. Mr. Feagin's principal work for the company will be in connection with public relations and legal matters. Mr. Feagin until his election as a vice-president of the Electric Bond & Share Company had been a member of the law firm of Baker, Botts, Parker & Garwood of Houston, Tex. He was born in Texas and had his education at Baylor University and Texas University, getting his law degree at the latter institution. He has also been a director and a vice-president of the Houston Lighting & Power Company, one of the companies associated with the Electric Bond & Share Company.

H. D. James Receives Promotion

H. D. James, formerly manager of the control engineering department of the Westinghouse Electric & Manufacturing Company, has been promoted to the position of consulting control engineer, and E. B. Newill has been appointed manager of the control engineering department.

Mr. James, a native of Baltimore and a graduate of the University of Pennsylvania, has been continuously associated with the Westinghouse company since 1904. Among the executive offices in engineering organizations he has filled have been president of the Engineering Society of Western Pennsylvania in 1922, chairman of the sub-committee of the Electric Safety Conference and chairman of the control section of the Electric Power Club. He is a fellow of the American Institute of Electrical Engineers.

Mr. Newill, a native of Atlanta, Ga., has been with the Westinghouse company since 1915. He is a graduate of the Georgia School of Technology at Atlanta.

S. M. Kennedy Retires

Samuel M. Kennedy, vice-president of the Southern California Edison Company, Los Angeles, in charge of business development and public relations, has announced his retirement from active service. About a year ago Mr. Kennedy met with a serious accident, breaking his hip and arm as the result of a fall. Since that time he has been physically incapacitated. A pioneer in the electrical industry on the Pacific Coast, Mr. Kennedy has been connected with the Southern California Edison Company for more than twenty years, having joined that organization in 1903 when the United Electric, Gas & Power Company was absorbed by the Edison company. For two years prior to the merger he had been affiliated with the United company as assistant to the president.

It is because of his great success in

S. M. KENNEDY

the field of public relations that Mr. Kennedy has become nationally known. Not only has he spent many years in the study of public relations, but he has contributed numerous articles and essays to the literature on that subject, among the best known being his essay "The Man on the Street" and his book "Winning the Public." Mr. Kennedy was born in Canada, and after receiving his education in that country he entered his father's business of importing, where he remained for ten years. Then he spent five years traveling before he settled down in California to take up his work in the electrical industry.

Fremont L. Lovett has been appointed general manager of the Rockland Light & Power Company, with headquarters at Nyack, N. Y., where he will be resident executive of the various properties in this region under the management of Charles H. Tenney & Company, Boston. Since April, 1921, Mr. Lovett has been manager of the Montpelier & Barre Light & Power Company of Vermont, but on the recent sale of this property to W. B. Foshay & Company of Minneapolis he resigned in order to continue with the Tenney organization. For four years prior to going to Montpelier he was on the engineering staff of the Worcester (Mass.) Electric Light Company. In his new post he will have general charge of the Orange County Light & Power Company, Middletown, N. Y., and of the Rockland company's subsidiaries in New Jersey and upper Pennsylvania.

Norman J. Richards, formerly district engineer of the Public Service Company of Northern Illinois in Joliet, has been appointed operating superintendent of that district. Mr. Richards was identified with the company's Oak Park office before removing to Joliet.

Earl G. Hines, general sales manager for the American Brown Boveri Electric Corporation, Camden, N. J., since March, 1926, has been elected a vice-president of that organization. Mr. Hines is well known in the electrical and allied industries. Early in his career he served as sales manager for Conger interests in central New York, and subsequently he identified himself with the organization of Harrison Williams, engaged in public utility organization and finance. He spent approximately ten years with the McGraw-Hill Publishing Company, Inc., New York, as Eastern manager of the ELECTRICAL WORLD and the *Industrial Engineer* before his appointment to the general sales managership of the American Brown Boveri company.

Obituary

Russell Robb

Russell Robb, senior vice-president and treasurer of Stone & Webster, Inc., died at Phillips House, Boston, on Tuesday morning of this week. Mr. Robb was one of the pioneer associates and earlier members of the firm of Stone & Webster and was known throughout the public utility industry as a sagacious leader of its inner councils. Modest and kindly in disposition, he was much beloved by those who came in contact with him. The development of Stone & Webster's organization from its small beginnings nearly 40 years ago to its present magnitude and influence is, of course, due to no single individual, but as the first partner in this enterprise to enter the firm after Messrs. Stone and Webster, Mr. Robb's share in its upbuilding and his sound influence upon the utility industry cannot be reduced to measurement.

Mr. Robb was born at Dubuque, Iowa, Dec. 6, 1864; was graduated from the Massachusetts Institute of Technology in 1888, being a classmate of C. A. Stone and Edwin S. Webster at that institution, and after two years of engineering service with the Thomson Electric Welding Company at Lynn, Mass., joined the engineering organization of Stone & Webster at Boston in 1891. In 1905 he was made a member of the firm and in 1920 was made senior vice-president and treasurer of the company which succeeded the former organization. He was an officer and director in a long list of public utilities in the traction, light and power field. In 1896 he was the author of a book on "Electric Wiring," and in 1909-11 he lectured at Harvard University on public utility topics, his "Lectures on Organization" being privately printed in 1909. He was prominent in civic life in his home town of Concord, Mass., and was a member of the American Institute of Electrical Engineers.

Benjamin N. Broido

Benjamin Nikolas Broido, chief engineer of the industrial department of the Superheater Company, of New York and Chicago, died suddenly at his home in New York City on Feb. 10. Mr. Broido was known throughout this country and abroad as a designer of exceptional ability of steam superheaters and heat exchange apparatus. He was born in Wilna, Russia, in January, 1879, and received his education in Germany, being graduated from a technical college in 1904 with a degree in mechanical engineering. For the next two years he was an instructor. From 1906 to 1912 Mr. Broido was connected with Aschersleben Maschinenbau A. G., Aschersleben, and later with Hannoversche Maschinenbau A. G., Hanover.

B. N. BROIDO

After removing his interests to this country he entered the employ of the Roessler & Hasslacher Chemical Company, Perth Amboy, N. J., for which he designed power plants. At the end of 1917 he became connected with the Superheater Company as designing engineer in charge of design and development of Elesco superheaters for stationary boilers.

In the course of the past nine years Mr. Broido had filed over 75 patent applications in this country and abroad for boilers, superheaters, economizers, heat exchangers, pipe stills, etc., and he contributed a number of articles to engineering magazines on diverse subjects.

Robert F. Brundage, district manager of the Mount Kisco branch of the Westchester Lighting Company and a son of Henry M. Brundage, a vice-president of the Consolidated Gas Company of New York, died at his home in Mount Kisco Feb. 13 after an illness of four weeks. Mr. Brundage was thirty-two years of age.

Charles Hugh Lounsbury, formerly secretary and treasurer of the Stamford (Conn.) Gas & Electric Company, died Feb. 9, following an illness of about three years. Mr. Lounsbury was one of the incorporators of the Stamford Savings Bank in 1887 and was

elected a director in 1890. In 1904 he became president, and he was chairman of the board of directors from 1924 until the time of his death. Mr. Lounsbury was secretary and treasurer of the Stamford Gas & Electric Company for a number of years and was a prominent stockholder in the company.

K. Kambe, president of the Tokyo Electric Light Company, the largest electric light and power company in Japan, died recently.

Edwin L. Stone, superintendent of the municipal light and power department of the city of Watertown, N. Y., died in that city Feb. 5.

Charles Waite Waller, who served as assistant general manager of the Great Western Power Company, San Francisco, in 1907, died in New York Jan. 19.

Dr. R. M. Powers, one of the incorporators of the original San Diego Gas Company, a predecessor of the San Diego Consolidated Gas & Electric Company, and actively identified with the central-station industry until 1905, died in San Diego, Jan. 14, at the age of 81. Shortly after its incorporation the gas company merged with an electric light company, and in 1887 Dr. Powers was selected as manager. He occupied that position until 1905, when he sold his interest to the present operators.

R. J. Davis, who had been San Francisco district sales agent for the Century Electric Company, St. Louis, for a number of years, died in San Francisco Jan. 9 in his sixty-fifth year. A native of New York, Mr. Davis transferred his interests to San Francisco in 1882, where he affiliated himself with the Pacific Bank and later with the San Francisco Gas & Electric Company, predecessor of the Pacific Gas & Electric Company. Subsequently he became representative of Eastern electrical manufacturers, and after engaging in that venture for some time he joined the Century Electric Company as district sales agent. In the course of his career Mr. Davis was interested in the *Journal of Electricity*, now *Electrical West*, having served as a member of its board of directors from 1906 until 1919, when it was acquired by the McGraw-Hill Publishing Company.

Sir James Kemnal, a pioneer in the development of electrical power, died in London, England, Feb. 9, in his sixty-second year. He was managing director of Babcock & Wilcox, Ltd., with which he had been associated for 40 years. Sir James was identified with many electrical societies and was president of the British and Latin-American Chamber of Commerce. He held membership in the Institution of Electrical Engineers, the Institution of Mechanical Engineers and the Institution of Naval Architects. In addition to his connection with Babcock & Wilcox he was chairman of Worthington, Simpson, Ltd., London and Newark; vice-president of Sociedad Española de Construcciones, Babcock & Wilcox, Bilbao, Spain, and a director of the French Babcock & Wilcox, Paris, and of the Power Securities Corporation, London. Sir James was a fellow of the Royal Society of Edinburgh and was knighted in 1924.

Recent Court Decisions

Power Companies Held Liable for Damage Done in Trimming Shade Trees.—The Tennessee Court of Appeals has held the Kentucky-Tennessee Light & Power Company liable to V. H. Smith for $500 damages alleged to have been caused to shade trees which were trimmed by its employees. The beauty and usefulness of the trees, which were three feet inside the plaintiff's property line, were found to have been spoiled.

"Property" Subject to Mechanic's Lien Includes All Material Used in Construction of Power Line.—The Third District Court of Appeal in California has found, in Western Electric Company vs. Cooley, that electric light poles, wires and all material used in the construction of a power line are "property" in a sense permitting foreclosure of a mechanic's lien upon them. The phrase "building or other structure" is not limited to objects similar in kind but includes all objects built on the soil. An electric power line is an "improvement" appurtenant to the soil, and that the line is built on a state highway does not alter its classification as property. (251 Pac. 331.)*

Negligence of Hydro Plant Owner Not Shown in Damage Suit Because of Drowning of Man Swept Over Dam.—Three men who crossed the Washita River in Oklahoma to repair a telephone line for the Chickasha Gas & Electric Company were on their return trip swept over the dam which formed part of the company's hydro-electric property and were drowned. Judgment for the company in a damage suit brought against it by the widow of one of the men (Osborn) has been sustained by the Oklahoma Supreme Court, which holds that, even assuming Osborn to have been an employee of the company, which was disputed on technical grounds, no negligence on the part of the company was established; that refusal of a safe place in which to work was not involved and no proof was offered of defects in the boat. "The evidence," said the court, "shows that the incident was one of those unfortunate accidents for which no one is responsible." (251 Pac. 480.)

Chelan Electric Company Declared a Public Utility.—In a case affecting the electrification in Washington State of the Great Northern Railway, the Supreme Court of that state has reversed the Chelan County Court and overruled one of its own past holdings as to what constitutes a public utility company. The case arose on an appeal by the Chelan Electric Company (owned by the Washington Water Power Company) from a judgment in the lower court denying to it the right to condemn land. It was brought about by the company's action in starting condemnation proceedings against riparian land owners whose property would be inundated by the raising of the lake level 25 ft. Since the power to be generated would be used in the ratio of 85 per cent for railroad haul and 15 per cent for manufacturing, it was held that a public utility was not involved. In 1905 the Supreme Court made a ruling in an appeal by the city of Tacoma concerning the White River project, involving power for mining, that a public service company was not involved as such. In the case just settled counsel for the Chelan Electric Company made the point that "changing conditions of society should now prompt the present body to a reconsideration of the past ruling, which would hinder development of one of the state's great resources."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Drawing the Line Between Urban and Rural Service.—Question arose in a case affecting the Willow River Power Company whether an electric line serving consumers in an unincorporated village was a rural or an urban extension. A rule filed with the Wisconsin Railroad Commission authorized a charge for the local equipment used in serving customers only if they were on a rural extension. The line was held by the commission to be a rural extension because (1) it appeared that the company had always treated the line as a rural extension and applied the rural rates and rules irrespective whether the consumers lived in the village or in the strictly rural territory served by the line; (2) prospective customers were advised prior to the construction of the line that they would be required to pay for the local equipment; (3) the village was settled and the characteristics in regard to electric service were more rural than urban, and (4) the annual revenue from the seventeen customers was only $582.73, which was about 20 per cent of the investment.

Federal Court Decree on Value Held Binding by Commission on Subsequent Petition.—The Indiana Public Service Commission has held in a case affecting the People's Utilities Indiana Corporation that in fixing the value of the property of a public utility for the purpose of sale it was limited by a finding of value by a federal court in a decision enjoining the commission from enforcing a rate schedule. It appeared that the United States District Court in Indiana had enjoined the commission from enforcing a rate schedule as promulgated by it for the Greensburg Water Company and made a finding that the value of the property was $340,000, and no appeal was taken from the decision. Subsequently the commission was petitioned to authorize a sale of the property for the suggested sum of $428,000 and to allow the purchasing company to issue securities in that amount in payment. But the commission held that it was bound by the finding of the federal court and therefore authorized the sale and the security issues only for the amount of $340,000 plus additions.

Financial and Statistical

Utility Bonds Make Further Gain
Stocks Have Receded Slightly
New Bond Issues Numerous

THE market for public utility bonds has been sufficiently firm and active to withstand the effect of the large number of new issues which have come forward in the past six weeks. High-grade issues have shown further price advances in many instances, and demand has been keen enough to bring the averages up to new high levels for a considerable period of years. According to dealers, private customers are taking an increasingly large proportion of bonds and there is a gradual expansion in institutional purchases. The average price of ten public utility bonds computed by the ELECTRICAL WORLD has risen steadily since the beginning of the year, the average weekly gain over that period being approximately one-seventh of a point.

Common stocks have receded slightly on the average, owing to the unusual market interest in other classes of securities, especially rails. The normally active issues have been unusually quiet during the past two weeks, gains being confined to a few stocks, such as Montana Power, Commonwealth Edison and Public Service of New Jersey. Two or three point recessions have not been uncommon.

A few gains have been made during the week by preferred issues, but the average remains practically unchanged. Over-the-counter trading in utility stocks has been very quiet. A few slight recessions are recorded.

Alabama Power Pays Million Dollars in Taxes

Taxes paid by the Alabama Power Company and its associated companies in Alabama in 1926, based on assessments as of Oct. 1, 1925, touched the million mark for the first time, the company officials have announced. Of the $1,000,526.61 total taxes paid to the state, counties and municipalities in the form of ad valorem, franchise, license and other forms of taxation, over $450,000 finds its way directly into funds for the benefit of education, in addition to such sums as are appropriated from the general fund of the state for educational purposes, a study of the report reveals.

Taxes payable in 1927, based on assessments as of Oct. 1, 1926, will be in excess of the million mark, it is pointed out, as several additional millions of dollars have been invested in power dams, lines and distribution facilities since the Oct. 1, 1925, assessments were made.

Commenting on the steadily increasing amount paid out by the power company and its associated companies for ad valorem, franchise, license and numerous other forms of taxation in Alabama, Thomas W. Martin, president, said: "It is interesting to note in connection with any statement of the amount of taxes paid by a public service corporation that the thousands of stock and bond holders of the corporation do not pay the taxes, but that after all they are paid by the people who use its service. So that instead of saying that Alabama Power Company paid so much taxes, it might be more accurate to say that our customers paid them."

Company Reports

The following statements of earnings have been issued by electric light and power companies:

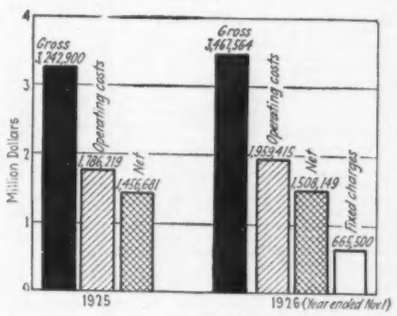
Name of Company	Gross Earnings Twelve Months Ended Dec. 31 1926	1925
Brooklyn Edison	$34,223,327	$29,887,300
Commonwealth Power	49,197,543	44,174,864
Community Power & Lt.	4,084,319	3,510,987
Los Angeles Gas & Elec.	17,611,709	17,049,592
No. American Company	115,850,466	93,028,966
Quebec Power	1,238,301	1,046,944
Western United Gas & El.	6,758,886	6,044,052
Wisconsin Public Service	4,454,565	3,980,288
York Utilities	202,323	182,278

Current Methods of Financing—III

Debenture Issues Gain in Popularity—Used for Refunding and for Improving Status of Subsidiary Company Stock

THE debenture is becoming increasingly prominent as a medium of financing the needs of the power and light industry. Last year 15 per cent of all capital raised was secured through the sale of debentures. Among the issues sold this year so far the percentage is still higher. This is due to the fact that the debenture is a particularly useful type of security for certain purposes and its use naturally increases when the market is favorable, as at present.

In general, the debenture is used when a company wishes to withhold the issue of its mortgage bonds for use at a time when other methods of raising funds are less favorable, or for an emergency. It may sometimes be resorted to in order not to overbalance the structure with a heavy mortgage debt. To finance new construction and new purchases, moreover, by means of long-term debenture bonds has become common practice. Then again it is sometimes considered advisable by holding companies to sell debenture issues of their own with the returns from which the stock of certain subsidiaries is purchased and the capital set-up of the latter thus improved. Frequently a block of mortage bonds which have been issued against new construction or purchases are retained in the treasury and debentures issued in their place. In case of growing and promising concerns, when it is anticipated that earnings will increase sufficiently as a result of added business to justify the retirement of the debentures, they may be made convertible into common or preferred stock.



REVENUE AND EXPENSES OF PEOPLE'S LIGHT & POWER COMPANY

PEOPLE'S LIGHT & POWER ISSUE

Typical of these debenture issues is that of the People's Light & Power sold recently to reimburse the company for the purchase, over a period, of a group of properties. While this issue is small in comparison with some that have been sold recently, it illustrates certain features of the debenture to advantage.

In connection with any issue of securities, the prospective investor naturally inquires why this particular type of securities was sold rather than some other. The answer to this question is necessary to a full understanding of any piece of financing. Why did the debenture best suit the purposes of People's Light & Power? As already suggested, the market is eminently favorable for the sale of this type of security; this is preferable to overburdening the structure with heavy funded indebtedness. The debenture in this case may be considered the mean between bond and stock financing. It has some advantages over both. As in the case under discussion, it enables the company to withhold its mortgage bonds and yet secure funds at a lower rate than if stock had been sold. Furthermore, the company will be able to get a higher price for its bonds on account of their quality.

While the sale of bonds would have saved approximately $25,000 in interest charges annually, the company and its bankers in creating the issue were obliged to consider these other factors, namely, what type of financing would best fit money market conditions and the existing capital set-up.

What protection has the investor in the case of unsecured obligations such as those under discussion? Protection in the case of People's Light & Power is assured by restrictions in the trust

agreement, which provides in substance that no further debenture issue will be made "except for refunding purposes unless the combined net income, as defined therein, of the corporation and its constituent companies after interest charges on secured debt, for twelve consecutive calendar months within the preceding fifteen calendar months, shall have been at least two and one-fourth times the annual interet charges upon all outstanding unsecured indebtedness of the corporation and its constituent companies, including the debentures to be issued." Furthermore, an apparently adequate maintenance and improvement fund based on gross earnings is provided for under the first-lien bond indenture.

Queens Borough Gas & Electric Increases Capitalization. — A certificate has been filed in the office of the Secretary of State changing the number of shares of capital stock of the Queens Borough Gas & Electric Company from 70,000 shares, $100 par value, to 150,000 shares preferred stock, $100 par value, and 500 shares common stock, no par value.

New Capital Issues

First mortgage gold bonds of the Interstate Power Company were offered during the week ended Feb. 17 to the amount of $20,000,000, the price being 97½ and accrued interest, to yield 5.16 per cent. These 5 per cent bonds, dated Jan. 1, 1927, and maturing Jan. 1, 1957, will be secured by a direct first mortgage on all real estate, plants, transmission lines and other fixed public utility properties of the company now owned or hereafter acquired and by the pledge of all outstanding bonds and capital stocks of subsidiaries owning the Wisconsin, North Dakota, Nebraska and Illinois properties included in the system. Proceeds received by the company from the present financing will be used in the retirement of previous bond issues of the company and of underlying bonds and preferred stocks of subsidiary companies, to permit consolidation of the properties into one operating unit, and for other corporate purposes.

The company also issued 6 per cent gold debentures to the amount of $7,500,000, the price being 98½ and accrued interest, to yield over 6.10 per cent. These debentures were dated Jan. 1, 1927, and mature Jan. 1, 1952.

The Chicago Electric Manufacturing Company recently issued 25,000 shares of class A stock at $25 per share. The proceeds of this issue of participating cumulative preference stock will be devoted to working capital for the company's increased requirements and to acquire inactive stock interests.

Kentucky Power Increases Capital.—Stockholders of the Kentucky Power Company at a meeting held Jan. 23 voted to increase the capital stock from $2,000,000 to $5,000,000.

Canadian Company Increases Capital.—A seven-million-dollar increase in the preferred stock of the Winnipeg Electric Company was authorized by a special general meeting of the shareholders held on Jan. 20. The stock will be increased from $3,000,000 to $10,000,000. In presenting the bylaw authorizing the sale of $7,000,000 worth of new preference shares, A. W. McLimont, president, reported that increased business, particularly electric

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Feb. 15	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	86½	83	87½
Adirondack Pwr. & Lt.—7% pf.	107½	101*	108½*
Adirondack Pwr. & Lt.—8% pf.	112	101*	115*
Ala. Pwr., 7% pf.	109½	....	....
Allis-Chalmers Mfg., 7% pf.	k109½	109	111
Allis-Chalmers Mfg., 6% com.	92	88	92½
Aluminum Co. of Amer., com.	72	....	....
Aluminum Co. of Amer., 6% of.	101	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	86½	86½	89½
Amer. & Foreign Pwr., com.—no par.	20½	19	23
Amer. Bosch Magneto, com.—no par	14½	13	17½
Amer. Brown Boveri Elect.	36½	34½	39½
Amer. Brown Boveri Elec., pf. $7.	k 96½	95½	98
Amer. Gas & Elec., 6% pf.—no par.	96½	96½	98½
Amer. Gas & Elec., com.†—no par.	70½	68½	100½
Amer. Lt. & Trac., 6% pf.	112	105*	132*
Amer. Lt. & Trac., com.†	230	224½	233
Amer. Pwr. & Lt., 6% pf.	100¶	97½	100
Amer. Pwr. & Lt., com.†—no par.	56½	54	61½
Amer. Pub. Serv., 7% pf.	k 96	92*	97½*
Amer. Pub. Serv., com.†	50	45*	80*
Amer. Pub. Utilities, 7% ptc. pf.	79	73*	89*
Amer. Pub. Utilities, 7% pr. pf.	89	86*	95*
Amer. Pub. Utilities, com.	m66	68*	82*
Amer. States Sec., A.	3½	2*	9½*
Amer. States Sec., B.	3½	1½*	5½*
Amer. Superpwr., $6 pf.—25.	k 28	26½	28½
Amer. Superpwr., 7% pf.	l 95	....	....
Amer. Superpwr., Class A†—no par.	k 29	27½	29½
Amer. Superpwr., Class B†—no par.	29½	28½	30
Amer. Wtr. Wks. & Elec., 7% pf.	k105½	105½	110½
Amer. W. W. & E., com. $1.20—20.	65	62½	67½
Anaconda Copper Cap. $3.	46½	45	49½
Appalachian Electric Pwr., 7% pf.	k 99	90*	101*
Appalachian Elec. Pwr., 2d pf., 7%.	98	99*	102*
Appalachian Elec. Pwr., com.	m78	....	....
Arizona Pwr., 7% pf.	80	60*	82*
Arizona Pwr., com.	23	....	....
Arkansas Cent. Pwr., pf.—$7 no par.	k102	99*	107*
Arkansas Lt. & Pwr., 7% pf.	102½	96*	104*
Arkansas Lt. & Pwr., com.	100	110*	115*
Assoc. Gas & Elec., $3.50—50.	51	....	....
Assoc. Gas & Elec., pf.—$6—no par.	87	79½*	86½*
Assoc. G. & E., Class A, $2.50—no par	40½	35	41½
BABCOCK & WILCOX, 7% com.	116½	117*	151*
Birghamton L., H. & P., $6 pf.	91	90*	95*
Birmingham Elec., pf.—$7—no par.	106½	101*	108*
Blackstone Valley G. & E., $6 pf.	102	103*	106*
Blackstone Valley Gas & Elec., 10% com.—50.	k105	100½*	106*
Blaw-Knox, com.†	k 71	70	78
Brazilian Trac., Lt. & Pwr., com.†	f118½	....	....
Broad River Pwr., 7% pf.	97	93*	98*
Brooklyn Edison, 8% com.	151½	148½	154½
Buffalo, Niagara & East. Pwr., pf.—25	i 25½	....	....
Buffalo, Niagara & East. Pwr., com.† —no par	i 28	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	95	89*	95*
California Ry. & Pwr., 7% pf.	105	88*	130*
Carolina Pwr. & Lt., pf.—$7—no par	f107½	107	108½
Central & S.W. Util., 7% pf.—no par	a 94½	93½	96½
Central & S.W. Util., pr. ln. $7 pf.—no par	a100	98½	101½
Central Ariz. Lt. & Pwr., 7% pf.	94	....	....
Central Ark. Ry. & Lt., 7% pf.	99	99*	101*
Central Ill. Pub. Serv., 6% pf.	k 86	89*	91*
Central Ind. Pwr., 7% pf.	87	84½*	93½*
Central Pwr. Lt., 7% pf.	101	94*	103½*
Central States Elec., 7% pf.	95½	92½	95½
Central States Elec., com.†	m200	200*	230*
Century Elec., 6% com.	m117	110*	117*
Chicago Fuse Mfg., com.—$2.50 no par	a 34	30	34
Cincinnati Gas & Elec., 5% com.	g 94½	93½	95½
Cities Service, 6% pf.	i 91½	91½	92½
Cities Service, pf. B—10.	i 8½	8½	8½
Cities Service, pf. BB—100.	i 83½	82	83½
Cities Service, com.—20.	i 58	50½	58
Cities Service, Bks. Shrs.—10.	i 29	25	29
Clarion River Pwr., 8% pf.	95	93*	95*
Cleveland Elec. Illu., 6% pf.	108	103*	109*
Cleveland Elec. Illu., 10% com.	300	240*	310*
Colorado Pwr., 7% pf.	k 95	96*	97*
Columbia Gas & Elec., 6% pf.	100½	99½	101½
Columbia G. & E. com. $5—no par.	83½	82½	91½
Columbia Ry., Gas & Elec., 6% pf.	94	65*	96*
Columbus Elec. & Pwr., 2d. pf.	103	....	....
Columbus Elec. & Pwr., 9% com.	55	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	99	98*	99½*
Columbus Ry., Pwr. & Lt., 6½% pf. B	106	....	....
Columbus Ry., P. & L., com.—no par	69	70*	85*
Commonwealth Edison, 8% com.	c140½	....	....
Commonwealth Pwr., 6% pf.	93½	91½	93½
Commonw'th Pwr., $2, com.—no par	44½	42½	45
Conn. Lt. & Pwr., 8% pf.	118	117*	121*
Conn. Lt. & Pwr., 7% pf.	112	108*	113*
Cons. Gas of N. Y., pf.†—50.	55½	57*	62½*
Cons. Gas of N. Y., com $5—no par.	98½	98½	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	c107½	106½	107½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	c111½	111	111½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	c115½	113½	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	c126½	126	127
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par.	e 51	51	52
Consolidated Pwr. & Lt., 7% pf.	106	100*	107*
Consumers Pwr., 6% pf.	101	95*	101½*
Consumers Pwr., 6.6% pf.	104½	101½*	106*
Continental Gas & Elec., 7% ptc. pf.	105	98*	109½*
Continental Gas & Elec., 7% pr. pf.	102½	95½*	101½*
Conti. G. & E. com. $4.40—no par.	220	85*	210*
Crocker Wheeler, com.†	36½	....	....
Crocker Wheeler, 7% pf.	85	....	....
DALLAS PWR. & LT., 7% pf.	106½	....	....
Dayton Pwr. & Lt., 6% pf.	102	95*	100*
Detroit Edison, 8% com.	k136½	133½	136½
Dubilier Condenser, com.—no par.	k 3½	3½	4
Dubuque Elec., 6% pf.	102	93*	98½*
Duquesne Lt., 7% pf.	k115½	115	116½
EASTERN NEW YORK UTIL., $7 pf.	102	80*	104*
Eastern New York Util. com.	65	70*	75*
Eastern States Pwr., $7, com.	11	12*	32½
Eastern States Pwr., pf.	93	89*	95*
East. Tex. Elec., 7% pf.	106	100*	107*
East. Tex. Elec., com. $5—no par.	90	70*	80*
Edison Elec. of Boston, 12% com.	d219½	....	....
El Paso Elec., com. $5—no par.	70	70*	94*
El Paso Elec., 7% pf.	102	102*	106½*
Elec. Bond & Share, 6% pf.	f107	107½	109
Elec. Bd. & Sh. Sec., com. $1—no par	f 68	68	72½
Electric Household Util.†	a 13½	11	14½
Elec. Investors, 6% pf.—no par.	93	87*	95*
Elec. Investors, com.†—no par.	34	33	37
Elec. Investors, 10% pd. receipts.	20	12*	56*
Elec. Pwr. & Lt., ctfs. pf.	97½	96	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	k104½	103½	104½
Elec. Pwr. & Lt., ctfs., full pd.	k104½	102½*	110*
Elec. Pwr. & Lt., ctfs., com.—no par.	17½	16½	18½
Elec. Refrig. cap.†	35½	30*	37½
Elec. Ry. Securities, com.—no par.	m 8	....	....
Elec. St. Battery com. $5.25—no par	75½	72½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	100	97½*	101½*
Emerson Elec., pf.	m105	101*	105*
Empire Pwr., A $6.	26	....	....
Engr. Pub. Serv., $7 pf.—no par.	m 99	93½	99
Engr. Pub. Serv. com. $7—no par.	23½	21½	24½
Eureka Vacuum Cleaner, com. $4—no par.	66½	66½	67½
FAIRBANKS MORSE, 7% pf.	k108½	107½	108½
F.-M., com.—$2.60—no par.	41½	38½	42½
Federal Lt. & Trac., com.†	42½	37½	42½
Federal Lt. & Trac., 5% pf.	94	92½	95
Ft. Worth Pwr. & Lt., 7% pf.	f108½	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	70	65*	70*
Galveston-Hou. Elec., com.	28	....	....
Gen. Elec., 8% com.	84½	81	85½
Gen. Elec., special—10.	11½	11½	11½
Gen. Gas & Elec. (Del.) com. A, $1.50—no par	44	40½	45
Gen. G. & E. (Del.) com. B—no par.	m 42	36*	48½*
Gen. G. & E. (Del.) pf. A $8—no par.	k115	113	115½
Gen. G. & E. (Del.) pf. A $7—no par.	k102½	100	107½
Gen G. & E. (Del.) pf. B $7.	k 97	96	98½
Gen. Pub. Serv., $7 pf.	k106	105½	106½
Gen. Pub. Serv., com.	13½	11½	14½
Ga. Lt., Pwr. & Rys., 6% pf.	90	82*	98*
Ga. Lt., Pwr., & Rys., com.	m 60	65*	80*
Ga. Ry. & Pwr., 8% pf.	k118	112*	122*
Ga. Ry. & Pwr., 7% pf.	106	100½*	108½*
Ga. Ry. & Pwr., 4% pf.	m119	....	....
Ga. Ry. & Pwr., 4% com.	120	....	....
Gt. Western Pwr., 7% pf.	h103	....	....
IDAHO PWR., 7% pf.	103½	103*	106*
Ill. No. Utilities, 6% pf.	k 88	88*	92*
Ill. Pwr. & Lt., 7% pf.	99½	96½	100½
Ingersoll Rand com. $8.	k 93	....	....
Int. Combus. Engr., com. $2—no par	51½	43½	51½
Int. Util., Class A—$3.50—no par.	k 31½	28	31½
Int. Utilities, Class B—no par.	30½	3	31½
Interstate Pwr., pf.—$7—no par.	94	90*	98*
Interstate Pub. Serv., 7% pf.	98	96½*	99½*
Iowa Ry. & Lt., 7% pf.	96	98*	100*
JERSEY CENTRAL PWR. & LT., 7% pf.	98	94*	98½*
Jersey Cent. Pwr. & Lt., 7% ptc. pf.	110	95½*	112*
Jersey Cen. Pwr. & Lt., com.—no par	k 25	25*	50*
Johns-Manville, com.†—no par.	62½	55½	66

Stock Exchange: cChicago; bSt. Louis; ePhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; kSan Francisco; qPittsburgh; jWashington. kBid price Saturday, Feb. 12. lBid price Wednesday, Feb. 16 mLatest quotations available. *1926. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Feb. 15	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	113	112	114¼
Kansas Gas & Elec., 7% pf.	*103¼	103	104
Kentucky Hydro-Elec., 7% pf.	a 95	94¼	96
Kentucky Sec.,6% pf.	85	75*	85*
Kentucky Sec., 5% com.	107	90*	108*
Kentucky Utilities, 6% pf.	95	90*	96¼*
Keystone Pwr. & Lt., 7% pf.	k97	95*	98¼*
LACLEDE GAS LT., 8% com.	180	173¼	183¼
Lehigh Pwr. Sec., com.—no par.	16½	15½	18
Long Island Ltg., 7% pf.	107	....	....
Long Island Ltg., com. $2—no par.	140	120*	150*
Los Angeles Gas & Elec., 6% pf.	99	95½*	100*
Louisville Gas & Elec., cl. A. $1.75	25¼	23¼	25¼
MAN. ELEC. SUPPLY, cap. $4.25—no par.	58½	53¼	60
Manila Elec., com.†—no par.	£ 38½	40	44
Maytag Mfg., com. .50—no par.	27½	23¼	28
Memphis P. & L., pf.—$7—no par	107½	103*	110*
Metropolitan Ed., pf.—$6—no par.	95	91¼*	98*
Metropolitan Ed., pf.—$7—no par.	104	102*	108*
Metropolitan Ed., com. $5—no par.	60	45	60
Middle West Utilities, 7% pf.	a111	....	....
Middle West Util., 7% pr. lien pf.	a119	....	....
Middle West Util., com. $6—no par	a112	....	....
Midland Utilities, pr. ln. 7% pf.	a102	....	....
Midland Utilities, 7% pf. A.	a 97	97	98
Milwaukee Elec. Ry. & Lt., 7% pf.	k101	100*	103*
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98	87*	100*
Minn. Pwr. & Lt., 7% pf.	*104¼	104	105
Miss. Pwr. & Lt., $8 pf.	108	102*	107¼*
Miss. River Pwr., 6% pf.	96	93*	96*
Miss. River Pwr., com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	102	....	....
Mohawk Hudson Pwr., 2d pf.—$7—no par.	98	90*	102*
Mohawk Hudson Pwr., com.—no par	25	20½	27
Montana Pwr., 7% pf.	m118½	118½	118½
Montana Pwr., 4% com.	85½	81½	85½
Montreal Pwr., 7½% com.	f 73	....	....
Mountain States Pwr., 7% pf.	99	97*	102*
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	99½	93*	101*
National Carbon, 8% pf.	m130	124*	130*
National Elec. Pwr., A†	23½	23½	25½
National Elec. Pwr., 7% pf.	k 94	93	95
National Lt., Ht. & Pwr., com.	24	22*	25*
National, Light, Ht. & Pwr., 5% pf.	70	71*	73*
National Pwr. & Lt., pf.—$7—no par	102	101½	103
National Pwr. & Lt., com.†—no par.	20½	19½	22
National Pub. Serv., 7% pf.	k 93½	87½*	95*
National Pub. Serv., 7% ptc., pf.	111	96*	112*
National Pub. Serv., A com. $1.60—no par.	20½	18½	21½
National Pub. Serv., B com.—no par	k 14½	14	16½
Nebraska Pwr., 7% pf.	*106	106	108½
Nevada-Calif. Elec., com.	k 25	25	26½
New Brunswick Pwr., 7% pf.	55	30*	60*
New Eng. Pub. Serv., pr. ln. pf. $7..	99½	98*	101*
New Eng. Pub. Serv., pf. $7.	93	95¼*	97*
New Orleans Pub. Serv.—7% pf.	103	100*	105*
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	89*	95*
N. Y. Central Elec., 7% pf.	102	98*	100*
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	98*	112*
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	98*	114*
Niagara Falls Pwr., 7% pf.—25.	28½	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	.11	110*	111½*
No. Amer., 6% pf.—50.	51	50	51½
No. Amer., com.—10.	49¼	45½	49½
No. Amer. Edison, $6 pf.—no par.	98	96½	100½
No. Caro. Pub. Serv., pf.—$7—no par	95	89*	96*
Northeastern Pwr., com.	18	16½	18½
No. Indiana Gas & Elec., 7% pf. A.	101	98*	103½*
No. N. Y. Utilities, 7% pf.	104	103*	105½*
No. Ohio Pwr., com.—no par.	11½	9½	12½
No. Ohio Trac. & Lt., 6% pf.	80	78*	81*
No. Ohio Trac. & Lt., 7% pf.	90	88*	96*
No. Ont. Lt. & Pwr., 6% pf.	k 87	75*	88¼*
No. Ont. Lt. & Pwr., 4% com.	74	73*	78*
No. States Pwr., 7% pf.	95	....	....
No. States Pwr., 8% com.	111½	109½	113½
No. Texas Elec., 6% pf.	75	48*	65*
No. Texas Elec., 4% com.	34½	27	31
OHIO BRASS, com. B $4—no par.	76	70*	80*
Ohio Brass, 6% pf.	100	98*	101*
Ohio Gas & Elec., 7% pf.	95	90*	95*
Ohio Pwr., 6% pf.	98½	90*	97*
Ohio Pub. Serv., 6% pf.	h95	94½	95
Ohio Pub. Serv., 7% pf.	*105	103¼	105
Ohio River Edison, 7% pf.	104	98½*	105*
Oklahoma Gas & Elec., pf.	98	....	....
PACIFIC GAS & ELEC., 6% pf.	24½	....	....
Pacific Gas & Elec., 8% new com.	31½	31½	33
Pacific Pwr. & Lt., 7% pf.	*103	102	104
Parr Shoals Pwr., 6% pf.	92	90*	97½*
Penn Cent. Lt. & Pwr., $5 pf.—no par.	c 73	71½	73
Penn-Ohio Edison, 6% pf.	80½	80½	82
Penn-Ohio Elec., 7% pf.	95	93*	96*
Penn-Ohio Pwr. & Lt., 7% pf.	100	94*	100*
Penn-Ohio Pwr. & Lt., 8% pf.	110	100*	111*
Penn Pwr. & Lt.—$7—no par.	*108	107	108½
Penn Pub. Serv., 6% pf.	87	85*	90*
Penn Wtr. & Pwr., 8% com.	183½	175½	185
Phila. Co., 6% pf.—50.	k 52	50	53
Phila. Co., com.—50.	88	85½	88
Phila. Elec., 8% com.—25.	c 50½	49½	54
Pittsburgh Utilities, 7% pf.—10.	m 18½	18	18½
Portland Elec. Pwr., 7% pf.	97½	97*	101*
Portland Elec. Pwr., 6% pf.	81	71*	87*
Portland Elec. Pwr., 6% 2d pf.	67	71*	75*
Portland Elec. Pwr., com.	29	26*	48*
Potomac Elec. Pwr., pf.	*110	....	....
Pwr. Corp. of N. Y., com. $1—no par	m79	77½*	90½*
Pwr. Sec., pf.—no par.	k 30	10*	39*
Pwr. Sec., com.—no par.	k 5	4*	13*
Public Serv. of Colorado, 7% pf.	i 99	99	99
Pub. Serv. of N. J., 7% pf.	*109½	108½	110½
Pub. Serv. of N. J., 8% pf.	126	125	126½
P. S. of N. J., $5 com.—no par.	34½	32	35
Pub. Serv. of No. Ill., 6% pf.	a105	102	105
Public Serv. of No. Ill., 7% pf.	a116	113½	116
P. S. of No. Ill., com. $8—no par.	a135	130½	136
Pub. Serv. of No. Ill., 8% com.	a135	132	136
Pub. Serv. of Okla., 7% pf.	99	92*	100*
Pub. Serv. Elec. & Gas, 6% pf.	104	102	104
Pub. Serv. Elec. Pwr., 7% pf.	k114½	113½	114½
Puget Sound Pwr. & Lt., 7% pf.	105	103*	108*
Puget Sound Pwr. & Lt., 6% pf.	84	82*	84½*
Puget Sound Pwr. & Lt., com.	31	....	....
RADIO CORP. OF AMER., pf.—50.	52	50½	52½
Radio Corp. of Amer., com.—no par.	54½	47½	56½
Republic Ry. & Lt., pf.	£115	95*	120*
Republic Ry. & Lt., com.	117	75*	116*
Rochester Gas & Elec., 6% pf. D.	105½	....	....
Rochester Gas & Elec. 6% pf. C.	k 102½	100	103
Rochester Gas & Elec., 7% pf.	106	105*	107*
SAFETY CABLE, com. $4.	58½	52½	59½
San Joaquin Lt. & Pwr., 7% pf.	106	97½*	108*
St. Joseph Ry., L., H. & P., 5% pf.	70	60*	70*
Servel Corp.	9	7½	9½
Sierra Pacific Elec., com.	24	....	....
Sioux City Gas & Elec., 7% pf.	101	96*	101½*
Southeastern Pwr. & Lt., pf.—$7 no par.	102½	....	....
Southeastern Pwr. & Lt., $6 ptc. pf.	68½	....	....
Southeastern Pwr. & Lt., com.—no par.	30½	30	32½
So. Calif. Edison, 8% pf.	36½	32½*	36*
So. Calif. Edison, 7% pf.	27½	....	....
So. Calif. Edison, 6% pf.	k 24½	24½*	25*
So. Calif. Edison, 8% com.	33	31½	34½
Southern Cities Utilities, 7% pf.	83	....	....
Southern Cities Utilities, com. $4.	25	..	....
Southwestern Lt. & Pwr., A $3.	63	52*	60*
Southwestern Lt. & Pwr., B.	60	38*	58*
Southwestern Lt. & Pwr., $6 pf.	85	78*	82*
Southwestern Pwr. & Lt., 7% pf.	k105	100*	105*
Springfield (Mo.) Ry. & Lt., 7% pf.	97	95*	100*
Standard Gas & Elec., 8% pf.	59½	57½	59½
Standard Gas & Elec., 7% pf.	106	104½	106
Standard G. & E., com. $3—no par.	55½	54	55½
Standard Pwr. & Lt., 7% pf.	96	90*	98¼*
Staten Island Edison, pf.—$6—no par.	98	93*	97½*
Superheater, $6 com.—no par.	167	138*	173*
Syracuse Lighting, 7% pf.	102	105*	107*
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.	300	260*	355*
TAMPA ELEC., com. $2.	60½	....	....
Tenn. Elec. Pwr., 6% pf.	90½	87*	90*
Tenn. Elec. Pwr., 7% pf.	102½	98*	105*
Terre Haute, Ind. & East. Trac., 5% pf.	20	20*	37*
Terre Haute, Ind. & East. Trac., com	1	1*	7*
Tex. Pwr. & Lt., 7% pf.	*107	106	108
Tide Water Pwr., 8% pf.	106	101*	106*
Timken Roller Bear., com.—$4 no par.	93½	78	94½
Toledo Edison, 8% pf.	*115	114	115
Toledo Edison, 7% pf.	*105½	104	105½
Toledo Edison, 6% pf.	i 95	94½	95
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	94	85	92
UNITED GAS & ELEC., 6% pf.	98	94*	97*
United Gas & Elec., com.—no par.	m57	56*	66*
United Gas & Elec. (N. J.) 5% pf.	70	70*	75*
United Gas Impr., 8% com.—50.	c 90	....	....
United Lt. & Pwr., pf.—$4—no par.	51	44*	53*
United Lt. & Pwr., pf.—$6.50—no par.	90½	87	93
United L. & P., com. A .48—no par.	13½	13½	15½
United L. & P., com. B .48—no par.	k 16	13	29
Utah Pwr. & Lt., 7% pf.	*105½	104	105
Utica Gas & Elec., 7% pf.	105	103*	106*
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	93	....	....
Utilities Pwr. & Lt., com. A $2.	29	27	29½
Utilities Pwr. & Lt., com. B $1—no par.	14½	13½	15½
VERMONT HYDRO-ELEC., 7% pf.	95	94*	96*
Virginia Elec. & Pwr., 7% pf.	105	101*	105*
Virginian Pwr., 7% pf.	108	102*	104*
Virginian Pwr., com.	70	65*	75*
WAGNER ELEC., 7% pf.	b 70	68	74
Wagner Elec., com.†—no par.	b 20½	18½	24
Washington Ry. & Elec., 5% com.	*206	....	....
Washington Ry. & Elec., 5% pf.	f 90½	....	....
Washington Wtr. Pwr., 8% com.	136	130*	138*
West Mo. Pwr., 7% pf.	m92	....	....
West Penn Elec., 7% pf.	106	102	107½
West Penn Elec., Cl. A $7.	102	97½	103
West Penn Pwr., 7% pf.	112½	111	114
West Penn Pwr., 6% pf.	m102½	100½	103
West Virginia Lt., Ht. & Pwr., 7% pf.	94½	95*	98*
West Va. Utilities, 7% pf.—50.	48½	43*	51*
Western Pwr., 7% pf.	99	98	101
Western States Gas & Elec., 7% pf.	92	89*	94½*
Western States Gas & Elec., com.	10	....	....
Westinghouse Elec. & Mfg., 8% com.—50.	73½	67½	73½
Weston Elec. Instrument, Cl. A $2.01—no par.	k 33	30½	34½
Weston Elec. Instrument, com.—no par.	18½	15	18½
Wheeling Elec., 6% pf.	95	91*	97*
Wis., Pwr., Lt. & Ht., 7% pf.	k 95	85*	91*
Worthington Pump, 7% pf. A.	k 49	46	50
Worthington Pump, 6% B.	k 41½	40	43½
Worthington Pump, com.	25½	20½	27
YALE & TOWNE com. $5—25.	k 73	70½	73½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Feb. 12. lBid price Wednesday, Feb. 16. mLatest quotations available. *1926. †Dividend rate variable.

light and power, had necessitated further capital expenditures, and to provide necessary funds for such expenditure, estimated at $60,000 to $70,000 per year, it had been considered advisable to sell preference shares rather than to borrow money on bonds.

Midland Utilities to Increase Stock.—Stockholders of the Midland Utilities Company will vote March 10 on increasing the authorized prior-lien stock from 200,000 shares to 250,000 shares and the class A preferred stock from 150,000 shares to 200,00 shares, par $100 each.

Puget Sound Utility to Increase Preferred Stock. — Stockholders of the Puget Sound Power & Light Company will vote March 7 on increasing the authorized preferred stock, no par value, from 200,000 shares to 300,000 shares. This will increase the total authorized capital stock to 100,000 shares of prior preference stock (par $100), 300,000 shares of preferred stock without par value, and 202,829 shares of common stock, no par value.

Massachusetts Utility Increases Dividend Rate.—The Charlestown (Mass.) Gas & Electric Company paid a quarterly dividend of $1.50 a share Feb. 1 to holders of record Jan. 20. In the two previous quarters disbursements of $1.25 regular and 25 cents a share extra were made.

Stockholders Vote to Issue Stock.—Shareholders of the North Boston Lighting Properties have voted to issue 60,130 additional shares of common stock to be offered both preferred and common stockholders, in the ratio of one new share for each four shares of either or both classes now held. The stock will be offered at not less than $90 per share. Proceeds will be used to retire notes and for additional working capital.

Iowa Utility Increases Capital.—The Iowa Electric Company, a subsidiary of the Iowa Railway & Light Corporation, Cedar Rapids, has increased its capital stock to $3,500,000. The new issue is divided into 35,000 shares at $100, 20,000 shares of which are in preferred and 15,000 in common. The previous capital was $3,000,000.

Syracuse Utility Issues New Shares.—The Syracuse Lighting Company, Inc., has issued 10,000 additional shares of authorized cumulative preferred stock at $100 a share, dividends to be paid quarterly at the rate of 6 per cent per year. This is the fifth issue of preferred stock to take place during the last five years. The first one was

10,000 shares at 8 per cent, the second was for the same amount of shares at 7 per cent, the third was at 6½ per cent, and the last two at 6 per cent, all issues of 10,000 shares.

Cambridge (Mass.) Company Sold

Announcement of the passing of the controlling stock interest in the Cambridge (Mass.) Electric Light Company was made this week at Boston, but the name of the purchaser had not been disclosed at this writing. The controlling interest was in the hands of the Cambridge Electric Securities Company prior to the present sale to interests who offered $187.50 per share for the stock, the par value being $25 on an option expiring Feb. 8. It is expected that the present management will continue. Persistent rumors name both the J. G. White and Albert Emanuel interests as concerned in the change of control.

Wisconsin Utility Stockholders Vote Capital Stock Increase.—At the recent annual meeting of the Wisconsin Public Service Corporation approval was voted of the plan recently projected to increase the capital stock of the corporation from $8,500,000 to $20,000,000. Consequently the number of preferred shares will be increased from 55,000 to 125,000, valued at $12,500,000, and common from 30,000 shares to 750,000 shares, valued at $7,500,000. The value of common stock at par is reduced from $100 to $10. It is not likely, however, that any considerable amount of the stock will be issued in the near future.

New York Utility Elects Directorate.—The election of the board of directors of the Oswegatchie Light & Power Company, Gouverneur, N. Y., was held Jan. 19. The members are M. M. Belding, W. B. Pollock, W. H. Stillhamer and S. J. McCrimlisk of New York City, Michael Doyle and Kendall B. Castle of Rochester, William C. Geer and Frank P. McCarthy of Troy, and F. N. Belding of Rockville, Conn.

Connecticut Company Increases Capital.—Stockholders of the Union Electric Light & Power Company of Unionville, Conn., have authorized the increase of capital stock from $600,000 to $1,000,000, and in accordance with that vote the directors have voted to issue 3,000 additional shares of common stock, par value $50, on a basis of one for four at par. The purpose of the issue is to reimburse the treasury for capital expenditures made and for contemplated extensions.

Recent Listings. — Additional preferred stock (par $25) of the Monongahela West Penn Public Service Company has been authorized for listing by the Baltimore Stock Exchange to the amount of $750,000. That exchange has also authorized the listing of first mortgage 6 per cent gold bonds, series B, of the Sodus (N. Y.) Gas & Electric Light Company, with authority to add $108,000 additional upon official notice that they have been sold. The Boston Stock Exchange has authorized the listing of 22,270 shares (without par value) of seven-dollar cumulative preferred stock of the General Public Utilities Company, these shares being the unstamped shares of a present outstanding issue of 23,237 shares.

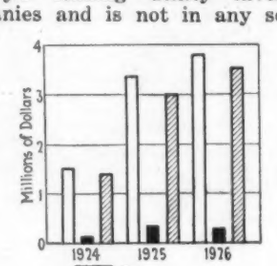
Henry Roberts Elected to Hartford Electric Board for the Fortieth Time.—At the annual meeting of the Hartford Electric Light Company, Hartford, Conn., Feb. 8, stockholders voted an increase in capital stock from $16,000,000 to $20,000,000. A bill asking for an amendment to the company's charter is now pending in the Legislature. This bill asks for a capital limit of $30,000,000. At the meeting announcement was made of the proposed addition to the South Meadow plant to include the installation of mercury boilers. Ex-Governor Henry Roberts, who has been a member of the board of directors of the company for 39 years, was honored at the meeting on the occasion of his election to the board for the fortieth time. Mr. Roberts was presented with a gold service pin set with diamonds by President Samuel Ferguson. All officers, directors and executive managers were re-elected.

American Superpower Shows Rapid Growth

Three Years' Progress Demonstrates Wisdom of This Company's Original Choice of Securities for Investment

A 14 PER CENT growth in gross income over last year and a 150 per cent increase over the year before is the American Superpower Corporation's record of progress over a three-year period. The history of the company's investment holdings reflects credit on those responsible for the choice of securities purchased.

American Superpower is one of the country's leading utility investment companies and is not in any sense a holding or an operating company. It was organized chiefly to purchase a minority interest in a well-diversified group of utilities. It acquired a portion of the common stocks of a number of successful light and power companies and the dividends on these largely constitute the company's earnings. Some additional earnings are received from the underwriting of issues and from trading.



EARNINGS RECORD OF AMERICAN SUPERPOWER DURING PAST THREE YEARS

YEAR'S EARNINGS RECORD

The majority of the companies whose securities are held have had a prosperous year. Sixty per cent of investments are in common stocks of companies with unbroken dividend records of fifteen years or more. In many cases dividends were increased during 1926. The company's balance available for dividends was about seven times dividends paid on first preferred and three and one-half times dividends paid on both classes of preferred stock. It was decided also to pay a special dividend of 50 cents a share on participating preferred stock in addition to the regular dividend.

Looking at the company's income statement, there are certain significant features. Gross revenue rose last year 14 per cent. Expenses and taxes combined decreased by the same percentage, allowing for a balance applicable to dividends last year of $3,528,158 against $3,031,092 in 1925. The balance carried to surplus was $1,000,033.

The capital set-up of the company includes capital stock and surplus with a book value of $45,722,860. There are two issues of preferred and two of common. The 100,000-share issue of first preferred is entitled to cumulative dividends of $6 per share per annum. The participating preferred carries 7 per cent dividends which are cumulative. Common is divided into class A and class B, of which the latter has sole voting power. The common issues are currently quoted around 29 and 29¼ and the preferred issues at 28 and 95.

Long Island Lighting Increases Stock.—Stockholders of the Long Island Lighting Company have increased the authorized capitalization by $10,000,000 in the form of cumulative preferred stock, par $100, to be issued in one or more series and in such number of shares and at such dividend rates, not exceeding 7 per cent per annum for each series, as the directors may determine.

Iowa Southern Utilities Authorized to Increase Capital.—The Iowa Southern Utilities Company has been authorized to increase its capital stock. The corporation will increase its preferred stock from 50,000 to 150,000 shares. As the preferred stock has a par value of $100 per share, the increased shares, if and when issued, would increase the capitalization by $10,000,000. This stock, however, will not be issued at the present time, but at such time as the business of the company and its future growth demand.

Cato (N. Y.) Utility Elects New Directors.—Stockholders of the Northern Cayuga Light & Power Corporation, Cato, N. Y., have elected these directors: C. E. Dudley, Frank Case, Fay C. Adams, Roy W. Turner, Frank O. Longley, James D. Bloomfield and John R. Ingersoll. The capital stock has been increased from $50,000 to $75,000. A semi-annual dividend of four per cent was paid on Feb. 15.

Manufacturing and Markets

Trade Association Activity

First Function Is to Build Confidence —Intelligent Co-operation and Open Rivalry Benefit All

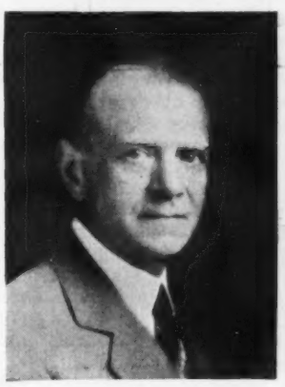
By D. Hayes Murphy*
Vice-president Supply Division N.E.M.A. and President Wiremold Company

FOR many years there has been talk of the misdeeds of trade associations, the abuse of power by large aggregations of capital, the exploitation of the public through exorbitant prices, restraint of trade and the like, but certainly none of the sections of the Supply Division of the National Electrical Manufacturers' Association need to be cautioned about avoiding these dangers. On the contrary, some of them are in dire need of assistance in eliminating the evils of an overdose of unintelligent competition.

The public, as an absolutely fair and reasonable party, would be surprised to learn of any well-organized, properly managed electrical manufacturing concern, or any department of such a concern, which was not making a satisfactory return on its investment in these prosperous times and would no doubt look with a sympathetic eye upon any reasonable effort to correct such a condition. Every one expects to pay a fair price and gives the business man credit for having common sense enough to include a reasonable profit in the prices charged for his goods. The public never demands a price so low as to rob the producer of a fair return, but on the contrary wants quality, demands safety and cheerfully pays for both. Furthermore, the public knows that quality and safety can only be had when the producer is allowed to operate at a fair profit.

For many years there has been a distinct trend toward lower prices and lower quality, and may it not be possible that some lines of electrical supplies have gone as far as is safe to go in that direction and that the time for a reaction has come? Certainly there is no crying need for still lower prices. In a highly competitive unorganized group, where the individual competitors depend upon rumor and the unfounded reports of salesmen and purchasing agents for their knowledge of the conditions of their own industry, it is to be expected that business will be unsatisfactory to the producer because he cannot make a fair profit and unsatisfactory to the consumer because he does not get a quality product. It is the lack of intelligent co-operative competition that is forcing some of our sections constantly to lower prices. Lower prices call for lower costs, and lower costs can be attained only through increased production and lower quality. Increased production means overproduction and overproduction means still lower prices. Thus the vicious cycle continues until business becomes unprofitable and the situation of the manufacturer is desperate.

The Supreme Court decisions in the cement and maple-flooring cases permit us to rest easy in the knowledge that trade associations, instead of being forced to prove themselves "not guilty," are to have the benefit of the fundamental principle that they are innocent until proved guilty. Until a short time ago we were very much in the dark as to what could and what could not be done, but the recent Supreme Court decisions have cleared up most of the uncertainty so that our attorneys can now tell us what the rules are. They are fair and workable rules, and when followed they will pay dividends to those who play the game.



D. Hayes Murphy

As examples of what may be accomplished it is refreshing to review the history of these associations and to note how the cement and maple-flooring industries were literally transformed from a condition of vicious cut-throat competition to one of intelligent co-operation and fair, honest, open rivalry. The competition is just as keen as it ever was and there is no restraint of trade, but the competitors are operating on a decidedly higher plane. Their business has been standardized and stabilized, and the best thing about it all is that customers and the public have been benefited as well as the manufacturers.

Confidence Needed First

All this has been brought about through the establishment of mutual confidence between members of the competing groups, without which co-operative effort is impossible, and without co-operative effort there can be no real progress. Obviously the first and most important function of the N.E.M.A. is to build up and firmly establish within each and every section that feeling of confidence and mutual trust which must serve as the foundation for any co-operative effort calculated to improve the condition of the industry. A fair trial by making use of the facilities of the trade association will show that its cost will fade into insignificance in comparison with the benefits derived.

*Excerpts from an address delivered at the semi-annual meeting of the Supply Division of the National Electrical Manufacturers' Association, New York, Jan. 19, 1927.

Sales Statistics on Direct-Current Motors

Orders entered for direct-current motors during the month of November showed a decrease as compared with the previous month, and the only months during 1926 in which smaller sales were recorded were May and July. It is expected that beginning Jan. 1, 1927, the number of units and the aggregate horsepower will also be included in these sales statistics.

ORDERS ENTERED AND SALES BILLED FOR DIRECT-CURRENT MOTORS

(1-hp. to 200-hp. inclusive, built in general-purpose motor frames, including control equipment sold with motors and excluding spare parts.)
(Issued by National Electrical Manufacturers' Association—Apparatus Division)

Month, 1926	Orders Entered	Billings
January	$815,976.75	$934,124.91
February	878,028.36	807,281.31
March	1,167,748.91	1,027,318.84
April	866,858.52	821,946.62
May	740,231.54	793,832.28
June	904,269.40	928,272.41
July	740,424.22	876,257.25
August	792,613.03	876,296.67
September	937,913.01	745,782.97
October	801,035.97	837,214.13
November	745,628.53	897,262.36
Year to date	$9,390,728.24	$9,545,588.85

Electric Industrial Trucks and Tractors

January shipments of electric industrial trucks and tractors, as reported to the Department of Commerce by the nine leading manufacturers in the industry, are as shown in the accompanying table.

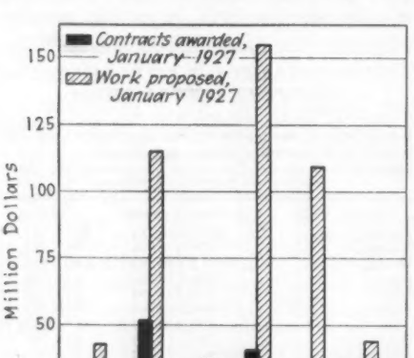
SHIPMENTS OF ELECTRIC INDUSTRIAL TRUCKS AND TRACTORS

	Domestic		
	Tractors	All Other Types	Exports
1926			
January	21	86	4
February	15	96	5
March	11	128	8
April	17	90	4
May	12	87	9
June	21	104	19
July	15	95	1
August	14	81	2
September	10	82	5
October	18	97	17
November	18	86	19
December	18	95	5
Total (year)	190	1,127	98
1927			
January	6	67	17

January Construction Under Same Month Last Year

Certain Classes of Work Show Gains—1927 Volume Should Nearly Equal That of 1926

ENGINEERING construction contracts let in the United States in January were 5 per cent below those of the corresponding period last year, according to *Engineering News-Record* statistics. Work in the proposed stage shows even greater recession, amounting almost to an 18 per cent decline from the January, 1926, level. The first month of 1926 started that year off with substantial gains over the same period in 1925 in both contemplated work and lettings. The construction volume index number for January was 187, and it was 228 for the whole of 1926 as compared with 100 for 1913. This means that the actual volume of contract letting in



CONTEMPLATED WORK COMPARED WITH CONTRACTS AWARDED

1926 (not the mere money value of the contracts let that year) was 128 per cent above the volume for 1913. The construction volume index number for January, 1926, was 198.

Despite this rather unfavorable start in 1927, the great bulk of projects proposed in 1926 should result in 1927 contracts less than 3 per cent under last year's volume, if not equal to it. January showed definite gains over the same month in 1926 in several classes of work, namely, streets and roads, commercial and public buildings, federal government construction and various privately owned unclassified jobs. The contract totals in the accompanying table, although covering the entire country on heavy engineering construction, are limited to certain minimum values, according to classification. By that is meant nothing under $15,000 on waterworks construction, excavating, drainage, irrigation, levee, river and harbor work. The minimum is placed at $25,000 for public works other than those just mentioned. Industrial buildings under $40,000 are considered too small, and commercial, educational, religious or other buildings below $150,000 are omitted.

The accompanying diagram shows the volume of proposed work in the various sections of the country as related to value of contracts already awarded. Indications are that the lead, now held by the Middle Atlantic group, will soon pass over to the Middle West, provided of course, that too many of these proposed projects are not abandoned.

Business Conditions

ACTIVITY continues in the electrical industry, and sales are at about the same level as in 1926. Manufacturers report that there are more inquiries than there were last year for the same period, and they are looking forward to many orders. Several large turbo-generator orders are in immediate prospect, and a 20,000-kw. unit was purchased in the Southeast. Industrial buying continues at a good rate virtually throughout the country, and industrial electric heating equipment is in active demand. The United States Steel Corporation has announced that its unfilled orders on Jan. 31 amounted to 3,800,177 tons, which was a decrease of 160,792 tons as compared with the previous month.

In New England inquiries for supplies and equipment show an increase and activity in heavy power equipment has strengthened. Sales of industrial electric heating apparatus and arc-welding equipment are active. Transformer inquiries are active in the New York district, and although sales to utility companies were not in large numbers, the general volume of business was considered satisfactory. In the Southeast an order was placed for a 20,000-kw. turbo-generator unit and a satisfactory business was done in line construction materials. Buying by industrial plants is active in the St. Louis district. Utility buying is active in the Middle West, and a number of orders for mechanical equipment were placed. Considerable business is expected in electric refrigeration units. Industrial plants are active buyers on the Pacific Coast, and power-company buying has also been good. Many motor orders were placed. Several sales to pulp and paper plants are anticipated at an early date.

Active Week in Copper and Lead-Zinc Improves

Copper and lead sales were active until Tuesday, when the demand for copper fell off somewhat. Copper prices were advanced gradually to the 13-cent level but lead remained steady. The copper market is stronger, for none of the larger producers is willing to shade the 13-cent offering. Much of the copper sold has been for prompt and March shipment. Zinc sales have been slightly better but continue considerably below normal. A little interest was exhibited in tin on Tuesday but the market has otherwise been quiet.

NEW YORK METAL MARKET PRICES

	Feb. 9, 1927 Cents per Pound	Feb. 16, 1927 Cents per Pound
Copper electrolytic	12 62½	12.925
Lead, Am. S. & R. price	7.40	7.40
Antimony	15¼	14¾
Nickel, ingot	35	35
Zinc spots	6.95	7
Tin, Straits	69¾	69
Aluminum, 99 per cent.	26	26

Base copper price Feb. 16, 1927, 14½ cents.

Transformer Inquiries Active in New York District

Sales to public utility companies in the New York district are dull, but considerable activity is reported in the volume of inquiries for transformers. Sales of line hardware, poles, and crossarms are fair, but individual orders are small. Some inquiries for switching equipment are reported and sales of this apparatus include an order for an installation of 66,000-volt switches for a South American company. In the industrial market a fair demand continues for general purpose motors, a

Value of Contracts Let in the United States and Canada During January, 1927

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Canada
Waterworks	$15,000	$145,000	$124,000	$390,000	$1,029,000	$977,000	**$2,680,000**	$109,000
Sewers	63,000	835,000	294,000	1,548,000	563,000	1,394,000	**4,697,000**	457,000
Bridges	129,000	1,224,000	1,657,000	337,000	673,000	141,000	**4,061,000**	.....
Excavation, drainage, irrigation	15,000	34,000	.....	29,000	177,000	348,000	**603,000**	.....
Streets and roads	422,000	6,058,000	6,383,000	2,178,000	5,706,000	3,486,000	**24,233,000**	280,000
Industrial buildings	1,055,000	5,280,000	325,000	3,403,000	2,470,000	9,045,000	**21,578,000**	125,000
Commercial buildings	15,760,000	36,136,000	3,378,000	31,330,000	9,775,000	14,906,000	**111,285,000**	700,000
Federal government	191,000	651,000	396,000	567,000	1,420,000	600,000	**3,825,000**	.....
Unclassified	875,000	1,018,000	159,000	322,000	2,628,000	3,676,000	**8,678,000**	3,357,000
January, 1927	**$18,525,000**	**$51,381,000**	**$12,716,000**	**$40,104,000**	**$24,441,000**	**$34,573,000**	**$181,740,000**	$5,028,000
December, 1926	19,746,000	65,051,000	19,572,000	57,709,000	30,858,000	36,667,000	229,603,000	3,647,000
January, 1926	7,972,000	71,085,000	24,855,000	40,901,000	25,821,000	20,013,000	190,647,000	7,384,000

considerable volume of small orders being reported from machine tool manufacturers. Many sales of motors for fans and small refrigerating machines are also included in the week's business.

Inquiries Show Increase in New England District

Inquiries for electrical supplies and equipment are being received in encouraging number in the New England district and according to prominent manufacturers compare favorably with the trend of a year ago. Activity in heavy power equipment has strengthened, and negotiations for turbo-generators indicate that orders will soon be placed for several units in this district. Small-motor sales mounted to over $50,000. Industrial electric heating is very active, and a prominent manufacturer reports more inquiries at hand for furnaces than at any time previous, with lead-pot furnaces, annealing and type-heating units attracting attention. Estimates for furnace-heating projects in this district are conservatively placed at more than $100,000, with machine tool and metal-working industries most prominent in the market.

Small switch and control apparatus are in good demand. A prominent manufacturer records negotiations for heavy-duty plant-control types with Southern interests active. Central-station supplies are moving steadily in small lots, with wire and fiber conduit in good demand. A manufacturer of electric arc-welding equipment reports sales so far this year about 20 per cent over the volume of last year. Jobbers are more active, and a good measure of new construction requirements is in view.

Order for Large Turbine Unit Placed in Southeast

The outstanding order placed in the Southeast was for a 25,000-kw. turbine for installation in the city plant at Jacksonville, Fla. An order for a 20,000-kw. turbine for a central station company in Florida will also be placed in the near future. The continued expansion programs of the larger companies and the anticipation of spring construction activities of the smaller are reflected in the satisfactory volume of orders for line-construction materials. An order for $25,000 worth of weatherproof and stranded bare-copper wire was placed, as well as orders for poles amounting to $9,200 and pole-line hardware totaling $5,000. Underground distribution system equipment was in active demand, and one company placed two orders for cable fittings amounting to $11,000.

The steel and iron interests continue reasonably active, the largest single order received recently from such sources being for oil circuit breakers aggregating $40,000 for installation in the Birmingham district. Another interesting order received was for 600 "white-way" posts for installation in a Florida city. Spring campaign activities by central-station companies are reflected in the brisk movement of appliances. One company has just finished a flatiron campaign and sold 5,679 irons in ten days.

Utility Buying Active in the Middle West

Some variations are noticeable in the volume of business transacted in the Middle West. Industrial activity is somewhat contradictory. Some lines of manufacture are unusually active while other lines are dull. Generally, the business outlook is good. Utility purchasing is unusually large, with very heavy buying of maintenance materials. Central-station orders called for six Coxe forced draft chain grate stokers with appurtenances; six induced draft fans; six forced draft fans with appurtenances; two duplex automatic bilge pump sets; nine auxiliary forced draft fans; six 17,000 sq.ft. plate type air heaters; one 40-in. forged and hammer welded steam receiver; 21,000 Muntz metal condenser tubes; four 13,000-amp. synchronous lighting converters; two 5,000-amp. synchronous railway converters, and twelve 450-amp., 12,000-volt current limiting reactors. Appliances continue to move readily. Considerable business is expected in electric refrigeration units during the next quarter, and a distributor has just placed an order valued at over $60,000.

Industrial Plants Active Buyers on Pacific Coast

Industrial sales on the Pacific Coast have been good and included orders for a 150-hp. motor, worth $10,000, for a Yosemite cement plant; $7,500 worth of motors for a Bay district cement plant; three motors, 40 hp., 60 hp. and 100 hp., valued at $2,500, for a lumber mill; eighteen motors, amounting to $3,500, for a lumber mill; $1,500 worth of supplies for a manufacturer of tractors and dredges, and numerous small orders from fruit-packing plants. Power-company buying has also been good and included an order for eighteen carloads of cross-arms for San Diego, to meet annual requirements; one carload creosote for a Fresno pole yard; $4,500 worth of 50,000-volt pin-type insulators for the Hawaiian Islands; four 500-kva. transformers, worth $15,000, and six carloads of 40-ft. and 45-ft. treated poles for the Monterey district. Railroad orders have been good.

In the Puget Sound district a 6,000-kw. transformer bank and 13,000-volt feeder switching equipment have been purchased for a new substation at Seattle. Plans have been filed for a new hydro-electric plant near Hoquiam, Wash. Orders from industrial plants included two 250-hp. variable-speed motors for a cement plant at Concrete, Wash.; four motors from 100 hp. down for a lumber mill at Seattle and pumps and motors for irrigation projects in Okanogan and Yakima counties. Plans for the construction of a three-hundred-and-fifty-thousand-dollar pulp mill in Tacoma are nearing completion, and specifications for a million-dollar unit of a pulp and paper mill to be built in Hoquiam are now being written.

Buying by Industrial Plants Active in St. Louis District

Industrial plant purchasing has commenced in fair volume in the St. Louis district. One order amounting to over $30,000 has been placed for medium-sized motors, transformers, motor-driven pumps and switching apparatus. A shipment of five motors was made to a factory in southern Illinois. One of the local steel companies placed a large order for motors and controls, and another order was booked for two automatic stokers to be installed in a power plant in the southeastern part of this district. Bids have been submitted for transformers, switches and accessories for several industrial substations, and estimates have also been made on the material for a 50-mile high-tension transmission line in Oklahoma. While no spectacular business has been reported, nothing but optimism for the business outlook was expressed by manufacturers, operators and jobbers interviewed.

Activities of the Trade

International Combustion Acquires Heine Boiler Company

The International Combustion Engineering Corporation, New York, announced the acquisition of the capital stock of the Heine Boiler Company, manufacturer of water-tube boilers. This acquisition gives the Combustion corporation large boiler-shop facilities at St. Louis, Mo., and Phoenixville, Pa. All types of water-tube boilers will be manufactured at St. Louis, including the new "sinuous header" type recently placed on the market. The manufacture of the Ladd water-tube boilers and the new Combustion steam generators will also be centered in the St. Louis plant.

The Combustion corporation states that the acquisition of the Heine company will enable it to furnish to its customers complete steam-generating units fired with pulverized fuel or mechanical stokers, all of its own manufacture. It is understood this new acquisition requires no financing by the International Combustion Engineering Corporation, the Heine company having been acquired through a cash payment. C. R. D. Meier will remain as president of the Heine Boiler Company.

Kelvinator Introduces New "Sealtite" Cabinet Model

Kelvinator Incorporated, Detroit, has announced the introduction of a new model cabinet Kelvinator, known as the "Sealtite." The new model has a cabinet of all-steel exterior, and is insulated with two inches of corkboard. It is finished in gray lacquer. The freezing unit uses the regular Kelvinator tank construction, and the condensing unit is said to be very efficient and compact. This model has been designed particularly for use in apartments and homes of the smaller type. The price is $195 f.o.b. Detroit, or $210 installed (slightly higher on the Pacific Coast).

In connection with the introduction

of this model, Kelvinator has also announced a nation-wide contest, in which forty-nine of these new units will be given away. One will be given in each state of the United States, and one in the Dominion of Canada, to the person in each state and Canada who writes the best letter telling what he knows about Kelvinator. Each entry for the contest must be filed with the local Kelvinator dealer and all letters must be submitted before March 31. A special booklet has been prepared for the purpose of helping those who enter the contest to get the necessary facts for writing their letters.

New York Edison's Fifth Annual Electric Power Show

The fifth annual electric power show will be held this year by the New York Edison Company at its showroom at Irving Place and Fifteenth Street, New York, Feb. 28 to March 5, and will illustrate the latest developments in the industrial trend toward individual motor drive. About 20 manufacturers of electric power equipment will exhibit small individually driven industrial units, such as electric drills, pumps, exhaust fans and cutting machines. A special feature will be made of electric pumps. Some newly perfected devices for industrial motor control will also be on display. The electric power show will be open free to the public from 9 a.m. to 6 p.m. every day during the entire week.

International Combustion Opens New Building

With its subsidiaries, the Combustion Engineering Corporation, the Ladd Water Tube Boiler Company, and the Raymond Bros., Impact Pulverizer Company, Inc., the International Combustion Engineering Corporation announces formal occupancy of its new building, the International Combustion Building at Madison Avenue from Thirty-fifth to Thirty-sixth Street, New York. The corporation states that the building is the sixth largest office building in the country and contains 600,000 sq.ft. of floor space. Owing to the Murray Hill restrictions it was necessary in the construction of the building to create a veneer of apartments on the Madison Avenue front and twenty-one apartments were constructed. In reality there are two buildings as the apartment building and the office building have no connection with each other.

The company's first offices consisted of a half floor of approximately 7,000 sq.ft. in the Bowling Green Building at 11 Broadway, New York. The rapid growth of the organization made it necessary in 1921 to build and occupy its own building consisting of eight stories and known as the Combustion Engineering Building at 43 Broad Street, New York, where it occupied five floors or a total area of 30,000 sq.ft. In less than three years the continuous growth made it necessary to rent floors in other buildings and with this formal occupancy of the International Combustion Building it expands its space to 80,000 sq.ft. with arrangements for additional space at later dates as its forecasted requirements develop the need for it. The company in 1926 booked slightly over twice as much business as in 1925 and present indications of business closed and pending in the early part of 1927 show a material increase over that of 1926.

Iroquois Electric Refrigeration Opens New York Showroom

A new showroom at 14 West Forty-eighth Street, New York, was opened this week by the Iroquois Electric Refrigeration Sales Corporation of New York, which has taken over the sale and distribution in the New York metropolitan district and northern New Jersey of the Iroquois electric refrigerators manufactured by the Barber Asphalt Company of Philadelphia. At the opening of the new showroom the Barber Asphalt Company was represented by C. W. Bayliss, vice-president; W. F. Hartzell, advertising manager and V. C. Kylberg, special representative. A very complete demonstration of the refrigerator was staged and a disassembled machine was available for inspection.

A luncheon was served at the Grand Street Boys' Club and interesting talks were made by O. H. Caldwell, editor of *Electrical Merchandising;* Fred F. Sly, editor of *American Architect;* S. A. Bennis, United Electric Light & Power Company; O. C. Small, Society for Electrical Development; C. W. Bayliss, Barber Asphalt Company, and J. B. Gottlieb, president of the new corporation. The officers of the new corporation are: J. B. Gottlieb, president; A. L. Mellman, vice-president, and H. O. Gottlieb, secretary and treasurer.

The Air Preheater Corporation, 25 Broadway, New York City, announces that G. O. French has joined its organization in the capacity of New York and Eastern sales manager. Mr. French for the past ten years has been associated with the New York office of the Walsh & Weidner Boiler Company.

The Pelton Water Wheel Company, San Francisco, has received a contract from the California-Oregon Power Company to furnish a 24,500-hp. reaction turbine for the Prospect No. 2 plant of the power company, now under construction in southern Oregon. Included in the order are all auxiliaries and a 6-ft. butterfly valve.

The General Electric Company, in accordance with its announcement of the establishment of a separate refrigeration department, printed in the Jan. 8 issue of the ELECTRICAL WORLD, will establish headquarters for that department in the Hanna Building, Cleveland. As stated in the announcement, T. K. Quinn will be general manager and P. B. Zimmerman will be sales manager.

The Long Bell Lumber Company, Kansas City, Mo., has received an order from the West Texas Utilities Company for 2,600 poles 50 ft. and larger for immediate delivery.

The Western Electric Company, New York, has announced the organization of the Electrical Research Products, Inc., Wilmington, Del., a subsidiary corporation formed to take over that portion of Western Electric business which is not related to the manufacture and distribution of telephone apparatus and supplies for the Bell System. All of the new corporation's stock is owned by the Western Electric Company. The field of the new company will include the commercial development of electrical devices and inventions controlled by the parent company and not suitable for distribution through the Graybar Electric Company, its subsidiary operating in the distribution of electrical supplies. J. E. Otterson, general commercial manager of Western Electric, becomes general manager of Electrical Research Products, Inc., with his office at 195 Broadway.

The Van Rosen Company, sales engineer and representative in New England for Delta Star Electric Company, Packard Electric Company, Bates Expanded Steel Truss Company and Matthews Patented Specialties, announces the addition of A. S. Hall to its sales force. New headquarters of this company are at 901 Statler Building, Boston.

The Killark Electric Manufacturing Company, 3940 Easton Avenue, St. Louis, manufacturer of "Electrolet" conduit fittings and bell-ringing transformers, announces that it has added nine new types of conduit bodies to its present line. These new bodies are made in all sizes from ½ in. to 2 in. inclusive.

The Allis-Chalmers Manufacturing Company, Milwaukee, has received an order from the city of Los Angeles for four 5,000-kva. synchronous condensers having a total value of $100,000.

The Hyatt Roller Bearing Company, Newark, N. J., announces the appointment of B. H. Lytle as manager of the industrial division at Pittsburgh.

Nelson & Hammett, Atlas Building, Tulsa, Okla., jobbers of electric and telephone supplies, announce that since Jan. 1 this company has been designated as Nelson & Company. C. B. Nelson is now the sole owner of the business.

The Robeson-Rochester Corporation, Rochester, N. Y., has purchased an 18-acre tract from the Progressive Foundry Company of that city and plans the erection of a new plant for the manufacture of electric household appliances and cutlery.

The Buffalo Forge Company and the Buffalo Steam Pump Company, Buffalo, N. Y., announce that since Jan. 1 their Philadelphia office in the Land Title Building has been in charge of W. S. Koithan and R. W. Pryor, Jr., who have for many years been joint managers of the New York office. These men will also continue to manage the New York district.

The General Electric Supply Corporation, Sixth Avenue and Thirteenth Street, New York, has been formed to succeed the Sibley-Pitman Electric Corporation, New York, and the Tri-City Electric Company, Newark, N. J., this arrangement dating from Jan. 1. The principal offices and warehouses will continue at Sixth Avenue and Thirteenth Street, New York, and at 52 Lafayette Street, Newark, and branch

warehouses to serve local communities will be maintained as heretofore. The officers of the new company are J. G. Johannesen, president; W. A. Kennedy and H. C. Calahan, vice-presidents, H. Q. Foreman, secretary and treasurer, and George H. Potter, assistant secretary and treasurer.

The L. D. McFarland Company, Ltd., Sandpoint, Idaho, manufacturer of Western cedar products, announces the opening of a sales office at 77 West Washington Street, Chicago, in charge of C. E. Kemmerer, who has been manager of sales at the Sandpoint office for the past four years. The company states that a modern open-tank butt-treating plant is under construction at Minneapolis, the third to be built and operated by it. Other plants are at Portland, Ore., and Sandpoint, Idaho.

Curtis Lighting, Inc., Chicago, manufacturer of "X-Ray" reflectors, announces that J. E. Lauderdale has been appointed sales manager. Mr. Lauderdale has been Chicago sales manager for the past eight years.

The General Electric Company has been awarded a contract by the Hastings (Neb.) municipality for installing a 2,000-kw. turbo-generator and switchboard, amounting to $40,740. A condenser unit costing $11,425 was also purchased from the Worthington Pump & Machinery Corporation of New York.

Deceleco Inc., Wayne, Mich., designer and manufacturer of complete bus and switch-cell structures, announces that Charles W. Koche, for many years connected with Johns-Manville in Cleveland, as manager of the electrical division, has been appointed sales manager.

The Rome Wire Company, Rome, N. Y., announces that it has opened a new warehouse at 199 Minnie Street, Detroit, for the purpose of serving the Detroit territory. This warehouse will be under the direction of Herman C. Joos, who has always been district manager in charge of the territory.

The Frigidaire Corporation, Dayton, Ohio, is arranging for the occupancy of the former plant of the Northway Motor Company at Detroit, recently taken over. The property will provide about 60,000 sq.ft. of manufacturing space, and will be used for expansion in electrical refrigerating equipment.

The Allis-Chalmers Manufacturing Company, Milwaukee, has secured an order for seven Timken-bearing equipped motors and pumps for pumping acid in the sulphite mill of the Oregon Pulp & Paper Company at Oregon City, Ore. The units range in size from 125 hp. down with a maximum capacity of 3,000 gal. per minute.

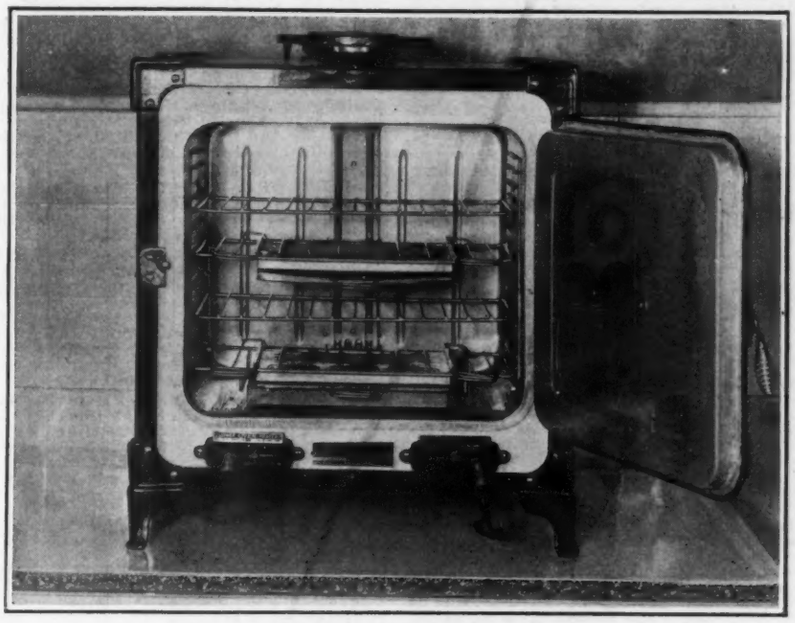
The Pittsburgh Transformer Company, Pittsburgh, announces the appointment of Lyman C. Reed, Hibernia Bank Building, New Orleans, as district representative to supervise sales and service work in the states of Louisiana, Mississippi and Arkansas. The Interstate Electric Company, also of New Orleans, will continue as jobber representative in that territory.

The Wagner Electric Corporation, St. Louis, announces the appointment of Howard P. Whalen as its sales representative in charge of its branch offices at Buffalo and Syracuse.

New Equipment Available

Electric Range

The New Era electric range, which is a portable unit that does not require any special wiring, has been placed on the market by the New Era Electric Range Company, 50 East Forty-second Street, New York City. The range has a lower and an upper element, both of which can be placed at any desired height. The continuous connection block can be seen in the accompanying illustration at the rear of the oven. The walls and door are insulated and the oven is fitted with a composition-stone heat retainer. The oven is a one-piece seamless unit and is made of aluminum. A quick-boil heater, as a part of the range, is placed on the top of and exterior to the oven. This heater is fitted with a special type of heat reflector.



PORTABLE INSULATED ELECTRIC RANGE

Induction Motors for Starting Across the Line

A complete line of induction motors, bearing the type designation "FT," ranging in ratings from 7½ hp. to 50 hp. and designed for across-the-line starting, has been placed on the market by the General Electric Company. The new motor marks the culmination of several years of investigation, development and research in the endeavor to meet the demand for a motor embodying simplicity, reliability, low cost and line-switch control involving full-voltage starting. While large numbers of high re-actance motors of somewhat similar characteristics have been built and applied during the period of development, this is the first co-ordination of a complete line for general-purpose application.

The "FT" motor is in general suitable for application wherever the ordinary squirrel-cage induction motor with a compensator has been used. It is designed to start on full voltage, giving slightly higher starting torque, but approximately the same starting current as the ordinary squirrel-cage induction motor started with the compensator connected to the 80 per cent tap. In appearance the new motors are the same as the ordinary squirrel-cage induction motor. Rotors are of the cast-aluminum type with bars so shaped and located in the punchings as to give a high-reactance effect at starting. Starting current is within the N.E.L.A. limitations up to and including the 30 hp. size. An ordinary line switch of proper capacity can be used for starting, but in order to obtain proper overload and undervoltage protection the motors are recommended for use with magnetic starting switches using push button control. Where necessary, on the larger sizes, a compensator or resistor starter may be used, as in the case of the ordinary squirrel-cage induction motor.

House Brackets

A series of house brackets has been added to the line of pole-line hardware made by the National Metal Molding Company, Pittsburgh. Channel-shaped pressed steel is used for the backs, and the U-straps that hold the insulators are made of pressed steel stiffened by a center groove pressed in the strap near the base. The manufacturer states that all metal parts are hot-galvanized by a new process that produces a uniform coating of zinc which will not crack or peel off. The insulators are made of high-quality porcelain by the dry process. The company has also made improvements in its general line of pole-line hardware.

New Trade Literature

WIRING DEVICES.—The Bryant Electric Company, 1421 State Street, Bridgeport, Conn., has issued its 1927 catalog, which contains listings and descriptions of the Bryant wiring devices, including outlets, switches, fuses, etc. It contains wiring diagrams for surface switches, flush switches and for burglar alarms or emergency circuits.

EMERGENCY KIT.—The Davis Emergency Equipment Company, Inc., 67 Wall Street, New York City, is distributing a bulletin which describes and illustrates the Davis "Electri-Kit," especially designed for the electric industry. The kit complies with the recommendations of the accident prevention committee of the National Electric Light Association.

RESISTANCE UNITS.—"How to Use Resistance in Radio" is the title of a booklet issued by the Ward Leonard Electric Company, Mount Vernon, N. Y., in which it tells how to use resistance in radio. It contains a description of the construction of the "Vitrohm" resistor and also instructions for the application of resistors in radio work. Illustrations are given of the various types of "Vitrohm" resistors with a special terminal or mounting.

ARC-WELDING ACCESSORIES.—Bulletin GEA-571 issued by the General Electric Company, Schenectady, N. Y., calls attention to its arc-welding accessories, including hand shield and helmet, protective colored glass, electrode holders, stabilizing, reactor, etc.

ELECTRIC LAUNDRY EQUIPMENT.—Leaflet No. 20,296 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, describes and illustrates the application of Westinghouse motors, reversing switches and starters to laundry tumblers, and also the motors and control for centrifugal extractors and irons. Illustrations showing typical applications of motors and control on laundry machines are included.

ELECTRIC FLASHING BEACONS.—The Crouse-Hinds Company, Syracuse, N. Y., is distributing bulletin No. 220, in which it describes its electric flashing beacons for traffic controls. It contains illustrations showing typical installations and also various types of lamps and mountings.

SMALL ELECTRIC MOTORS.—"Brass Tacks About Small Motors" is the title of a small booklet issued by the Master Electric Company, Dayton, Ohio, in which it gives a standard of comparison by which the relative merits of any small-motor purchase may be determined. The company is also distributing the second of a series intended to be helpful to motor buyers generally entitled "Brass Tacks About Selecting Motors," in which it calls attention to the advantages of standardization of motor drive for electrically driven machines.

OIL-ELECTRIC TUGBOAT.—A booklet issued by the Ingersoll-Rand Company, 11 Broadway, New York City, describes and illustrates the "New York Central No. 34" oil-electric tugboat, equipped with Ingersoll-Rand oil engines. It also contains a short sketch, entitled "Thirty Years of Marine Development and a Great Railroad," covering the marine activities of the New York Central Railroad from 1898 to the advent of the "New York Central No. 34," which marks an epoch of economical marine transportation.

STEEL FLOOR GRATING.—The Walter Bates Steel Corporation, Gary, Ind., is distributing folder F-1, covering the Walter Bates Steel floor grating for use in central stations, power plants and industrial buildings.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Rangoon, India (No. 24,027), for electrical cooking appliances, and wiring and lighting accessories, best quality.

An agency is desired in Berlin, Germany (No. 24,028), for electrical appliances. Also for electric refrigerators (No. 24,011).

Purchased and agency are desired in Bagdad, Iraq. (No. 24,027), for electrical appliances, especially desk fans.

An agency is desired in London, England (No. 24,021), for electrical hairdressing appliances.

Purchase is desired in Karlsruhe, Germany (No. 24,002), of electric refrigerators.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Edison Electric Illuminating Company has acquired a site on Arch Street for a proposed substation. The Whidden-Beekman Engineering Company, 100 Boylston Street, is engineer.

NEEDHAM, MASS.—Plans have been filed by the Edison Electric Illuminating Company, Boston, for the erection of a substation on Chestnut Street.

BRISTOL, CONN.—The proposal to establish an ornamental lighting system in business section of the city has been approved by the City Council. The Bristol & Plainville Electric Company furnishes the street-lighting service.

HARTFORD, CONN.—Plans are being considered for extensions and improvements to the street-lighting system in the business section, to cost about $18,000.

HARTFORD, CONN.—The Connecticut Electric Service Corporation plans to erect a steel-tower transmission line from a point near Meriden, where connection will be made with the system of the Connecticut Light & Power Company to Montville, where it will connect with the lines of the Eastern Connecticut Power Company, about 40 miles, to cost about $500,000.

LITCHFIELD, CONN.—Plans are being considered by the Litchfield Electric Light & Power Company for extending its distribution lines to New Fairfield, Morris, Bethlehem and Washington.

Middle Atlantic States

BINGHAMTON, N. Y.—Plans have been approved by the Binghamton Light & Power Company for increasing the capacity of its steam-driven electric plant by about 30,000 kw., to cost about $400,000.

BROOKLYN, N. Y.—Bids will be received by the Commissioner, Department of Mental Hygiene, Capitol, Albany, until March 2, for refrigeration work, kitchen and dining room building "N" Creedmoor Division, Brooklyn State Hospital, Queens.

FRANKLINVILLE, N. Y.—Improvements are contemplated to the street-lighting system, including the installation of ornamental lamps in the business section.

MALONE, N. Y.—The Malone Light & Power Company has applied for permission to extend its distribution system in the town of Bellmont, Franklin County, and for approval of franchise granted by the Town Board. The company also contemplates extending its lines to serve the hamlets of Owls Head and Mountain View.

OSSINING, N. Y.—The Westchester Lighting Company, Yonkers, will soon take bids for the erection of a service, electrical and mechanical repair building at Central Avenue and Water Street, to cost about $100,000. H. B. McLean, 18 South Broadway, Yonkers, is architect.

OSWEGO, N. Y.—At an election held Feb. 13 the proposal to lease the water power at Dam No. 6 in the Oswego River in Oswego to the Carlisle interests for a period of 25 years was carried. Under the terms of the lease the Carlisle interests agree to pay an annual rental of $50,000 and to build a power plant, to cost about $850,000, this plant to revert to the city at the expiration of the lease.

SCOTIA, N. Y.—Negotiations are under way between the village authorities and the Adirondack Power & Light Company for the installation of an improved lighting system throughout the village.

WOLCOTT, N. Y.—Plans are under way by the Northern Wayne Electric Light & Power Company for improvements to its system, including a tie in with the Niagara, Lockport & Ontario Power Company at Savannah. A substation will be erected at Savannah, equipped with transformers of 2,000 kw., for which orders have been placed. The cost of the work is estimated at $50,000.

NEWARK, N. J.—Improvements and extensions are contemplated by the Public Service Corporation to its system during 1927 for which $57,000,000 is available. Of this amount $25,461,000 will be expended in the electric department, of which $2,500,000 will be used for the installation of the fifth unit of boilers, consisting of three boilers of 2,360 hp. each, at the Kearney power station; about $12,000,000 is assigned to the development of electric transmission facilities; $7,000,000 for the building of new switching stations; $9,000,000 for substations and distribution; $1,000,000 for underground conduits in congested districts, etc.

BUTLER, PA.—Extensions and improvements are contemplated by the West Penn Power Company, Pittsburgh, in its local system, to cost about $80,000.

TARENTUM, PA.—Steps have been taken by the business men and merchants on West Seventh Avenue for the installation of a new street-lighting on that thoroughfare. It is proposed to install lamps from Bull Creek Bridge to Peterson.

BALTIMORE, MD.—The Board of Public Improvements is considering extensions in the electrical underground conduit system in the business district, to cost about $1,000,000. B. L. Crozier is chief engineer.

HOPEWELL, VA.—The construction of a new electric plant (to cost about $50,000) is under consideration by the Prince George Electric Light Company. The plans call for two units of 200 kw. and 300 kw. respectively, Diesel engines, etc.

RICHMOND, VA.—The Virginia Electric & Power Company plans to build an outdoor switching station at its local power plant.

North Central States

JACKSON, MICH.—Extensions and improvements are contemplated by the Con-1927, to cost about $15,000,000, of this amount $11,183,880 has been appropriated for the electric department. The proposed work includes the erection of a 140,000-volt transmission line from Jackson to Lansing, 40 miles long; the installation of a 30,000-kw. generating unit and auxiliary equipment at the Saginaw River plant; completion of the pulverized-fuel installation at the Kalamazoo plant, etc.

PONTIAC, MICH.—The Oakland Motor Car Company plans to build a power plant in connection with proposed extensions to its works, to cost about $5,000,000.

AKRON, OHIO.—Plans are under consideration by the Northern Ohio Traction & Light Company for the installation of a centralized steam heating plant in the downtown district, to cost about $1,000,000.

CHILLICOTHE, OHIO.—Bids will be asked at once by the City Council for the installation of an ornamental lighting system in the downtown district, to cost about $28,000.

CLEVELAND, OHIO.—Plans are being prepared by the Cleveland Railway Company for two substations to cost about $500,000. L. D. Bale is engineer and architect.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Feb. 25 for weatherproof copper wire; bids will also be received at the time and place for structural steel supports and runways for economizers for boilers 1 to 6, for the Division of Light and Power.

COLUMBUS, OHIO.—The City Council is considering the installation of an ornamental lighting system on Broad Street in the business district, to cost about $50,000.

MOREHEAD, KY.—The Kentucky Power Company, Augusta, which has acquired the local electric plant, plans to increase the output of the plant by 750 kw. immediately. The plans provide for an ultimate capacity of 10,000 kw.

EVANSTON, IND.—The erection of a number of new buildings to include the Armour College of Engineering, with complete electrical and mechanical equipment, to cost about $10,000,000, is under consideration by the board of trustees of Northwestern University.

HAMMOND, IND.—Plans are under way by the Harter Industrial District for the construction of a central power and heating plant at 151st Street and Columbia

Avenue, to cost about $1,500,000. C. Retz is manager.

WABASH, IND.—Plans are under consideration by the City Council for the installation of a new street-lighting system in both the business and residential sections of the city. Electrical service is supplied by the Northern Indiana Power Company, Kokomo.

AURORA, ILL.—The Public Service Corporation, Chicago, has applied for permission to extend its service in Aurora Township.

CHICAGO, ILL.—The construction expenditures for the operated and affiliated public utilities of the Standard Gas & Electric Company, 231 South La Salle Street, for 1927, will total $61,500,000, according to an announcement of H. W. Fuller, vice-president in charge of engineering and construction, of the Byllesby Engineering & Management Corporation. The largest expenditure will be made for the Pittsburgh properties where a total of $26,000,000 will be expended. The Colfax steam-electric generating plant will be increased from 190,000 kw. to 270,000 kw. capacity. Extensive switching facilities will be installed in connection with the Brunot Island plant at Pittsburgh. Continuation of work on the 108,000-hp. hydro-electric station for the Louisville Hydro-Electric Company at the falls of the Ohio River at Louisville, and the completion of the hydro-electric development of the California-Oregon Power Company on the north fork of the Rogue River. The initial development will have a capacity of 15,000 kw., which will eventually be increased to 45,000 kw.

DIXON, ILL. — The Illinois Northern Utilities Company is securing right-of-way for its proposed 132,000-volt, steel-tower transmission line from South Beloit to Belvidere.

KEWANEE, ILL.—The Illinois Power & Light Corporation, Chicago, will soon begin work on the erection of a substation at the outskirts of Kewanee, which will be the junction point for four super-power lines from Keokuk. Iowa, Peoria, Rock Island and Joliet. All the lines will carry 132,000 volts except the Keokuk, line of 66,000 volts.

LITTLETON, ILL.—Permission has been granted the Central Illinois Public Service Company, Springfield, to purchase the public utility properties, owned by L. L. Horney, and to establish electric service in the Horney area.

TROY, ILL.—Preliminary plans are being prepared for a municipal electric light and power plant and distribution system, to cost about $65,000. Edward Flad & Company, 916 Chemical Building, St. Louis, is engineer.

EAU CLAIRE, WIS.—The Dells Paper & Pulp Company contemplates extensions to include the installation of additional equipment in its power plant. Douglas & Kryster, 425 East Water Street, Milwaukee, are engineers.

GREEN BAY, WIS.—The budget of the Wisconsin Public Service Corporation for 1927 provides for an expenditure of $1,680,000 for extensions and improvements to its properties. Of this amount $650,000 will be used for its electric system, chiefly for extensions into the rural districts; $2,000,000 for completion of the Bayside steam plant at Green Bay. About $625,000 will be expended on its electric railway and bus properties.

MILWAUKEE, WIS.—To meet the increasing demand for electrical service in Wisconsin and northern Michigan the Milwaukee Electric Railway & Light Company and five other North American Wisconsin-Michigan subsidiaries will expend about $11,449,000 during 1927 for improvements and additions to their properties. The amount to be expended in the Milwaukee area, including the Wisconsin Electric Power Company, owner of the Lakeside power plant, and the Milwaukee Northern Railway, will be $8,048,300. Of this amount $3,556,170 will be used for expansion of the light and power properties, while $4,492,180 will be expended for extensions and improvements to the eelctric railway and bus transportation services. While there will be no additional units built at the Lakeside plant until 1928, there will be some construction work during 1927. The remaining $3,403,250 of the budget will be divided among the other associated companies for extensions and improvements as follows: Wisconsin Gas & Electric Company, operating in Racine, Kenosha, Waukesha, Watertown, Burlington and other smaller communities in southeastern Wisconsin, $2,052,800; the Wisconsin Traction, Light, Heat & Power Company, operating in the Appleton district, $774,180; the Badger Public Service, operating in Elkhart Lake and other smaller communities in Sheboygan County, $119,280; the Peninsular Power Company, operating in northern Wisconsin and Michigan, $456,950.

NEENAH, WIS.—The City Council is considering the installation of a street lighting system on North Commercial Street, using concrete and metal standards.

MINNEAPOLIS, MINN.—The City Council is considering the installation of an ornamental lighting system on Sixth Avenue North. N. W. Elsberg is city engineer.

SIBLEY, IOWA.—Plans are under way to extend the service of the municipal electric plant into the George, Iowa, and Bigelow, Minn., districts.

SIOUX CITY, IOWA.—The City Council is planning the installation of an improved fire alarm system.

ST. LOUIS, MO. — The Kingshighway viaduct, southwest and Loughborough Avenues and Delor Streets are the principal thoroughfares on which electric lamps will be installed during 1927 under the ordinance providing for the installation of new lamps in various parts of the city. On the Kingshighway viaduct seventy-eight 400-cp. electric lamps will replace the present gas lamps. On Southwest Avenue new lamps will be installed, while on Loughborough Avenue and Delor Street electric lamps will be substituted for gas lamps.

HURON, S. D.—The Northwestern Public Service Company has applied to the State Railway Commission for authority to erect several transmission lines from its North Platte plant into the rural districts of Lincoln County.

FREMONT, NEB.—Extensions and improvements are contemplated to the municipal electric light and power plant, to cost about $150,000. Burns & McDonnell Engineering Company, Interstate Building, Kansas City, Mo., is engineer.

COFFEYVILLE, KAN. — Plans for the proposed local repair shops and yard terminal of the Missouri Pacific Railway Company, St. Louis, to cost about $600,000, include a power plant. E. A. Hadley is chief engineer.

RANSOM, KAN.—The Western Light & Power Company, Salina, is negotiating for the municipal electric distribution system and transmission line.

Southern States

CHARLOTTE, N. C.—Surveys are being made by the Southern Power Company, Charlotte, from Northwilkesboro to Elkin, as part of a project of the Southern Public Utilities Company, Winston-Salem to furnish electricity to another loop linking the towns of Taylorville, Ronda, Roaring River, Elkin and North Wilkesboro.

NORTH WILKESBORO, N. C. — The Southern Public Utilities, Inc., Winston-Salem, is considering extensions in its transmission line in this district.

WILMINGTON, N. C.—The City Council contemplates extensions and improvements in the fire-alarm system.

AINSLIE, GA. — The Ainslie Limerock Company plans to build a substation at its plant.

ATLANTA, GA.—The Georgia Utilities Company, a subsidiary of the Georgia Railway & Light Company, will erect a 2,300-volt, three-phase distribution and street lighting system in Toomsboro, Irwinton, McIntyre, and a 2,300-volt distribution in Stonewall, and will also rebuild the distribution systems in Union City and Kennesaw.

CORDELE, GA. — Surveys have been authorized by the Power Commission of Crisp County, Cordele, of a proposed site on the Flint River, for a county hydro-electric plant. The cost, including a transmission system, is estimated at $1,250,000.

FORT LAUDERDALE, FLA.—The installation of ornamental lamps on the North and South River Drives is under consideration by the city officials.

TAMPA, FLA.—Bids will be received by the City Commission at the office of the city clerk, until Feb. 28 for furnishing miscellaneous equipment for the Tampa Municipal Hospital, including lighting fixtures, X-ray equipment, vacuum cleaning equipment, sterilizers, etc.

CHATTANOOGA, TENN. — The City Council plans to install an improved lighting system in the Highland Park and Ridgedale districts. The Tennessee Electric Power Company furnishes street lighting service here.

ALBANY, ALA.—Plans are being considered by the Alabama Power Company, Birmingham, to build a substation at East Albany, to cost about $150,000.

DECATUR, ALA.—Plans are under way by the Alabama Power Company, Birmingham, for the erection of a 110,000-volt primary substation of 7,500 kw. capacity in Decatur. Energy for the proposed station will be taken from the 110,000-volt line connecting Huntsville and Sheffield. The major electrical equipment has been purchased.

DOTHAN, ALA. — The Gulf Electric Power Company, a subsidiary of the Southeastern Power & Light Company, Birmingham, plans to erect a 110,000-volt transmission line from Union Springs to Dothan.

PRATT CITY, ALA.—The City Commission has tentative plans for the installation of an ornamental lighting system in the down town district. Pratt City is a suburb of Birmingham.

JACKSON, MISS. — Improvements and extensions are contemplated by the Mississippi Power & Light Company during 1927, to cost about $3,000,000. The work will include the erection of three 110,000-volt transmission lines, one from Cleveland, Miss., to Memphis, Tenn.; one from Indianola to Winona, and from Jackson to Amite, La., and also to build about 200 miles of 13,000-volt line and to rebuild distribution systems in twenty towns.

BARTLESVILLE, OKLA.—The Bartlesville Gas & Electric Company is negotiating with the Kansas Gas & Electric Company, Wichita, Kan., and two other companies for the purchase of energy to meet the increasing demands for electrical service in Bartlesville.

FAIRFAX, OKLA.—T. C. Hughes and associated engineers, of Tulsa, have applied to the Oklahoma Drainage, Irrigation and Reclamation Commission for permission to divert the water from the Arkansas River at a point near Kaw City and conduct it through a concrete canal for 14 miles to a point near Fairfax, where the water, after generating 30,000 hp. of energy, would be emptied into Salt Creek. The cost of the project is estimated at $2,000,000.

MUSKOGEE, OKLA.—H. G. House, 11 Severs Building, Muskogee, is at the head of a project to construct a hydro-electric plant on the Illinois river, with an initial output of 20,000 hp., to cost about $750,000, with transmission system.

DALLAS, TEX.—The installation of an ornamental lighting system on Peak and Bryan Streets is under consideration by the City Commissioners.

FORT WORTH, TEX. — The Electrical Department has been authorized by the City Manager to install 100 pendant arc lamps, in parts of the city heretofore unlighted. This is in addition to the 650 lamps authorized to replace the old type lamps throughout the city.

HOUSTON, TEX.—Plans are under way by H. Roberts and G. W. Cigyshall, 321 Thompson Street, San Antonio, for the construction of an ice plant here, to cost about $75,000.

HOUSTON, TEX.—Improvements to cost about $4,730,700 will be made by the Houston Lighting & Power Company to its plants and system during 1927, according to a report submitted to C. F. Kirk, public service commissioner of Houston. About $2,200,000 will be expended for new turbines and improvements to its power plant at Deepwater.

Pacific and Mountain States

HOQUIAM, WASH.—William H. Hopkinson, Aberdeen, and associates, have applied for permission to build a hydro-electric power development on the Humptulips River, near Hoquiam, to cost about $500,000, with transmission system.

SEATTLE, WASH. — The Puget Sound Power & Light Company plans to expend $100,000 in raising the Baker River an additional 30 ft.

SEATTLE, WASH.—Clark R. Jackson, superintendent of the Seattle public utilities, has recommended that a committee be appointed by the city to formulate plans for placing underground all wires and removing all poles of both the City Light

Department and the Puget Sound Power & Light Company.

OAKLAND, ORE.—Romaine Myers, Oakland, and associates, have applied for permission to build a hydro-electric plant on the Illinois River in Josephine County, with initial output of 15,000 hp.

FORT MASON, CAL.—Bids will be received by the Constructing Quartermaster, Fort Mason, until Feb. 28, for one steam turbo-generator, and generator panel for the power plant at the Letterman General Hospital.

FRENCH GULCH, CAL. — The Pacific Gas & Electric Company, San Francisco, which has acquired the local electric distribution system, plans to rebuild and extend the same.

FRESNO, CAL.—The City Council plans to call an election to submit the proposal to issue $350,000 in bonds for extension to the police and fire-alarm system, automatic traffic signals and purchase of site for municipal air port.

PITTSBURG, CAL. — The City Council plans to install ornamental lamps on East Third Street. George T. Oliver is city engineer.

POMONA, CAL.—Bids will be received by T. R. Trotter, city clerk, until March 1 for the installation of an ornamental lighting system, consisting of 138 standards on Holt Avenue, to cost about $25,000.

SANTA ANA, CAL. — The Board of County Supervisors is considering the installation of ornamental lamps on the Coast Boulevard, requiring ninety-one two-lamp standards.

MAYER, ARIZ.—The Crown King Mining Company is planning to build a substation in connection with a proposed 200-ton ore mill in the Bradshaw Mountain district.

COLORADO SPRINGS, COLO. — The City Council is considering the installation of an ornamental lighting system in the business district, to cost about $25,000. F. O. Ray is city engineer.

DENVER, COL.—At an election held Feb. 8 the proposal to grant the Public Service Company of Colorado a twenty-year franchise was approved. The company has announced that it contemplates an expansion program involving an expenditure of $40,000,000 during the next few years. The work will include the addition of a fourth generating unit and more boiler equipment at the Valmont power plant, north of Denver, to cost about $700,000; construction of a new warehouse and service building in Denver, to cost $500,000. About $450,000 will be spent on extensions of electric distribution systems, gas mains, etc.

Canada

LETHBRIDGE, ALTA. — M. Freeman, commissioner of the municipal electric plant, has submitted a recommendation to the City Council advising the purchase of a 3,000-kw. turbo-generator for the municipal electric plant. The cost is estimated at $100,000.

VANCOUVER, B. C.—Plans have been approved by the provincial government for the construction of a hydro-electric plant at Campbell River Falls by the Crown Willamette Paper Company, 248 Battery Street, San Francisco, to operate its proposed newsprint mill on Vancouver Island. The entire project will cost about $10,000,000.

CANSO, N. S.—Improvements are contemplated to the municipal electric light plant, including the installation of a steam engine, boiler, etc., to cost about $15,000.

BELLEVILLE, ONT.—Right-of-way has been secured by the Hydro-Electric Power Commission of Ontario for the erection of a power line from the east side of the Cordova side of the Canadian Northern Railroad as far as Bannockburn. The proposed line is to be erected from the Gatineau Rapids on the Ottawa River to Toronto.

BEAUHARNOIS, QUE.—The Beauharnois Electric Company plans to erect 10 miles of transmission line, to cost about $50,000. R. Beaumont, 473 Victoria Street, Montreal, is engineer.

CAP DE LA MADELEINE, QUE.—The installation of an ornamental lighting system, to cost about $10,000 is under consideration. R. Morisette is engineer.

QUEBEC, QUE. — The installation of traffic signals and fire-alarm system on various streets, to cost $15,000 each, have been authorized. J. A. Trembly is engineer.

Electrical Patents

Announced by U. S. Patent Office

(Issued Jan. 18, 1927)

1,615,043. LIGHTING FIXTURE; E. Samuelson, Chicago, Ill. App. filed Oct. 7, 1925. Of the type suspended from ceilings.

1,615,106. BATTERY SWITCH; P. H. Bethea, Washington, D. C. App. filed Aug. 3, 1925. Constructed and arranged to be mounted locally upon the battery.

1,615,109. ELECTRIC FURNACE; J. R. Coe, Waterbury, Conn. App. filed April 3, 1923. Rocking electric furnace in which the cylinder is readily separable from the electrodes and their carriers so that it can be lifted from its cradle and carried to any convenient point and there tilted so as to pour out its contents.

1,615,130. MEANS FOR ADJUSTING ELECTRICAL INDUCTANCES; I. L. Milton, Western Springs, Ill. App. filed Oct. 22, 1924. Method of and means for balancing coupled electrical inductances.

1,615,153. STATION INDICATOR; E. Alessio, New York, N. Y. App. filed Feb. 17, 1926. For use on subways and street railways, or for other similar uses to give visual indication to passengers of the station being approached.

1,615,163. ELECTRICAL TIME SWITCH; C. W. Brown, Mount Vernon, Wash. App. filed Aug. 30, 1912. With thermostatic control.

1,615,166. ELECTRIC WATER HEATER; A. E Cowles, Kellogg, Idaho. App. filed July 10, 1925. In which the water, having passed through the jacket, becomes heated before entering the coils to be there subjected to the direct heat of the coils.

1,615,187. BOND-WIRE CONNECTOR AND BOOTLEG TERMINAL; W. F. Bossert and J. C. Edwards, Utica, N. Y. App. filed June 19, 1923. A device for establishing permanent and solid electrical connection between two rails of a railroad track or to an electrical connection between a rail and an extraneous instrument; particularly designed for use by railroads in connection with electrically operated signal devices.

(Issued Jan. 25, 1927)

1,615,294. ELECTRICALLY HEATED BLANKET; W. H. Turver, Los Angeles, Cal. App. filed May 12, 1923.

1,615,295. ELECTROMAGNETIC LIGHT-BATHING APPARATUS; G. von Hutschler, Windenburg, Germany. App. filed Aug. 23, 1924.

1,615,302. FLUSH RECEPTACLE; P. Hartmann, Brooklyn, N. Y. App. filed Sept. 30, 1922. For use with selective polarity plugs.

1,615,329. HANGER BAR FOR OUTLET BOXES; V. T. Jennings, Chicago, Ill. App. filed Aug. 22, 1923.

1,615,365. ELECTRIC GOVERNOR SWITCH; C. C. Farmer, Pittsburgh, Pa. App. filed June 16, 1922. For pump governor.

1,615,373. STEP-BY-STEP ROTARY ELECTRIC SWITCH; B. C. Garman, West Hampstead, London, England, and C. Oliver, Chislehurst, England. App. filed Feb. 12, 1926. Of the rapid make-and-break type. Capable of giving a wider variation of circuit control without undue complication or multiplication of parts. More than three electrical circuit connections and a single "off" position are obtained by the employment of a number of "points" or angular switching positions equal only to the number of circuit connections plus the one "off" position.

1,615,425. COATED CORE; H. G. Walker, Berwyn, Ill., and A. T. March, Chicago, Ill. App. filed March 29, 1922. A core coated with pulpous material.

1,615,429. INTERLOCK MECHANISM; H. F. Woernley, Wilkinsburg, Pa. App. filed Sept. 29, 1922. A mechanism for interlocking the operation of an electric switch with the operation of a fluid pressure controlling cock.

1,615,450. MULTIPLE SWITCH; G. W. Grisdale, Philadelphia, Pa. App. filed Oct. 31, 1923. Automatic switch for connecting a plurality of electrical circuits one at a time to another circuit for indicating, recording, or any other purpose.

1,615,451. THERMOCOUPLE; T. R. Harrison, Philadelphia, Pa. App. filed Feb. 1, 1926. Means for protecting thermocouples employed in measuring the high furnace temperature from injurious contact with the furnace gases.

1,615,464. ELECTRIC SADIRON; J. E. Marsden, Philadelphia, Pa. App. filed Sept. 24, 1925. Having automatic means for regulating the temperature.

1,615,508. ELECTROTHERAPEUTIC APPARATUS; K. Fukuyama, Los Angeles, Cal. App. filed May 9, 1925. Portable electro-inductive device and thermo-electrodes in combination therewith.

1,615,552. LIGHT-PROJECTING APPARATUS; W. A. Pennow and R. S. Haynes, Milwaukee, Wis. App. filed May 14, 1925. A light-projecting apparatus in which an electric arc is employed, and in which the parts are so positioned that material discharged from the arc will fall clear of the mechanism and consequently such mechanism will not become clogged.

1,615,555. ELECTRIC CIGAR LIGHTER; J. Shipley, Athens, Tenn. App. filed July 14, 1924.

1,615,582. THERMAL SWITCH; H. C. Hawkins, Winston-Salem, N. C. App. filed Feb. 10, 1922. Responsive to a rise of temperature, the device being of utility for signaling when a fire starts in a building.

1,615,604. MOTOR; L. J. Wahl, Sterling, Ill. App. filed June 28, 1926. A prime mover mechanism which may be suitably actuated by an alternating current passing through an electromagnet to control a vibratory armature. Capable of operating through the agency of a single-phase alternating current, is self-starting and has a large starting torque.

1,615,636. SIGNALING SYSTEM; I. Langmuir, Schenectady, N. Y. App. filed June 5, 1919. For receiving signals and producing an audible indication of the signals received. System for producing a desired indication by means of currents of inaudible frequency.

1,615,647. DRIP-PAN ALARM; H. L. Pierce and A. Pierce, Ellet, Ohio. App. filed April 25, 1925. For refrigerator drip pans.

1,615,648. MEASURING INSTRUMENT; R. T. Pierce, East Pittsburgh, Pa. App. filed April 29, 1924. For measuring the resistance of electrical circuits.

1,615,661. TERMINAL FOR ELECTRIC HEATING UNITS; E. E. Sutherland, Mansfield, Ohio. App. filed March 24, 1924. Terminal member of an encased heating unit.

1,615,662. BRUSH HOLDER; R. L. Tuttle, Schenectady, N. Y. App. filed March 18, 1926. Means for providing a protective coating on brush holders constructed of magnesium or aluminum and their various alloys.

1,615,664. CLOCK MOVEMENT; H. E. Warren, Ashland, Mass. App. filed Aug. 18, 1926. With driving connection between the clock motor and the hands thereof whereby second, minute and hour hands may be mounted on the same axis and co-operate with the same dial, and whereby the slower moving hands may be readily adjusted with respect to the driving motor for the purpose of setting the clock. A signaling device to be employed when the clock is driven by an electric motor to indicate when the power has been off and the clock needs resetting.

1,615,665. MEANS FOR CONTROLLING DRIVING MOTORS; P. Weiske, Berlin, Germany. App. filed July 9, 1925. In such a manner as to obtain synchronism of a number of such machines or to cause them to be operated at a predetermined speed.

1,615,666. METHOD OF AND APPARATUS FOR FORMING FILAMENTS; D. K. Wright, Paterson, N. J. App. filed Jan. 29, 1917.

1,615,669. AUTOMATIC SWITCHING SYSTEM; H. Bany, N. Y. App. filed Feb. 6, 1925. Which are adapted to effect the operation of a plurality of devices in a predetermined sequence.

1,615,670. SYSTEM OF ELECTRIC DISTRIBUTION; H. Bany, Scotia, N. Y. App. filed June 15, 1925. In which a load circuit is adapted to be supplied by a plurality of sources of current.

1,615,677. RELAY SYSTEM; F. M. Gillhimer, Wilkinsburg, Pa. App. filed June 3, 1922. Load-limiting relay system.

1,615,678. REGULATOR SYSTEM; W. M. Bradshaw, Wilkinsburg, Pa. App. filed July 13, 1922. System of control for a plurality of dynamo-electric machines and it has special relation to combined governing and regulating means. A system that shall be responsive to certain electrical characteristics of each of the machines to govern the connecting together and the parallel operation of the machines.

1,615,683. ELECTRIC AIR HEATER; O. A. Colby, Irwin, Pa. App. filed Oct. 11, 1923. That shall heat the surrounding air partially by radiation and partially by convection.

Business Facts for Electrical Men

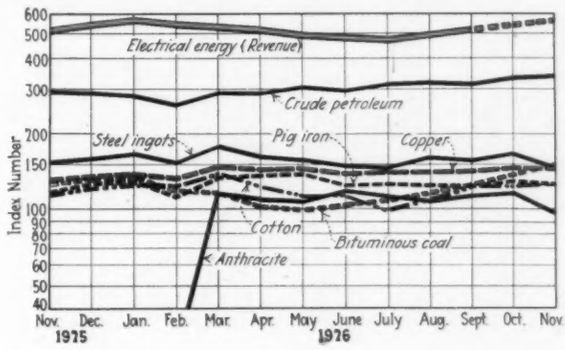
Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

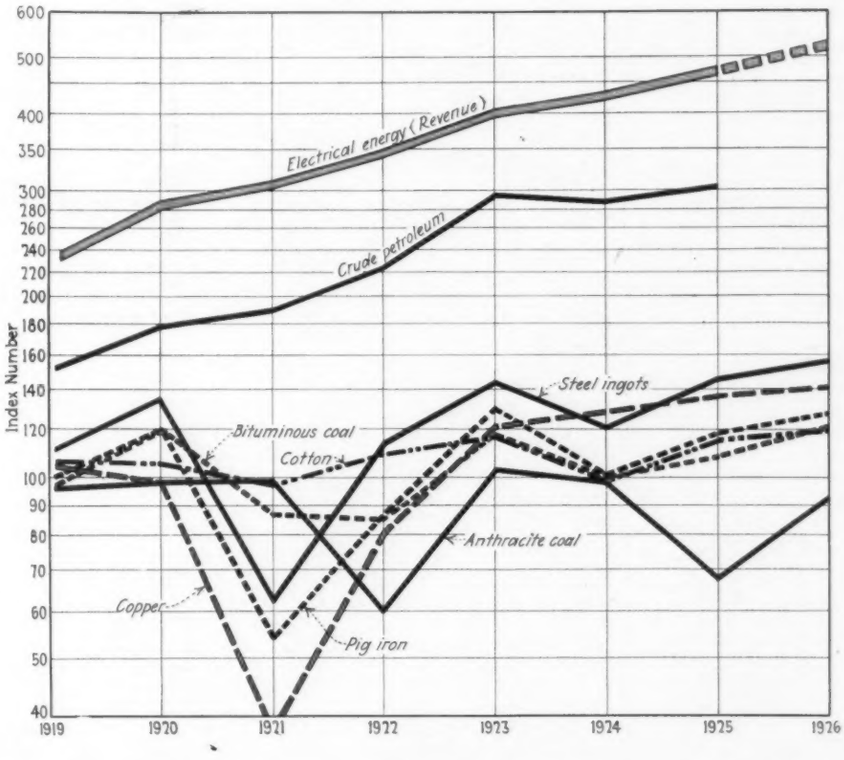
The Fastest Growing Basic Industry

Production Index Numbers
(1913 Production = 100)

At Right, Monthly Since November, 1925

Below, Yearly Since 1919





HALF a century ago the manufacture of electrical energy as a basic industry was unthinkable. Twenty-five years ago it was important, but probably not indispensable; today it is a vital function in our economic life. Electrical energy enters into our manufactured products as truly as do pig iron and steel and coal and copper. To measure its consumption in any given industry is to hold a finger on the pulse of that industry, sensitive to every change.

Of all our forms of basic production, none has grown so rapidly as that of electrical energy. This is evident from a table of index numbers recently published by the Chamber of Commerce of the United States under the title "Business Indicators." Taking 1913 as a base, electrical energy production had increased nearly fivefold by the end of 1925, and on the basis of additional data collected by the ELECTRICAL WORLD it is evident that the index number 500 was well exceeded in 1926.

Further, as has been stated many times, there has never been a recession in revenue, and in only one year, 1921, was there even a moderate reduction in energy output. The figures here charted are in substantial agreement with indices worked out from gross revenue for the various years, as published in ELECTRICAL WORLD'S annual statistical issue. Apparent slight discrepancies are due to revisions incorporated in one group of figures and not in the other. The differences are in no case serious.

Being plotted to a scale in which constant percentage of growth is shown by a straight line, as is customary when charting index numbers, the electrical curve makes it evident that, excepting for a slight peak in 1923, a constant rate of progress has prevailed with remarkable steadiness since 1920, averaging 11 per cent a year, compounded.

It is worth noting, too, that 1920 appears in retrospect to have been somewhat of a turning point in this regard, the average rate from 1913 to 1920 being close to 16 per cent. It thus seems reasonable to assume, purely on the basis of past experience, that the percentage growth will gradually diminish, although the numerical increase (kilowatt-hours or dollars) will not only be maintained but will continue to become greater for many years to come. Necessarily, this leaves out of consideration the effect of disturbing influences, except in so far as similar influences have operated in the past and hence are automatically taken into account. Moreover, the effect of even the worst of such disturbances is essentially temporary, as recent experience has shown.

The nearest approach to correspondingly rapid growth is found in the output of crude petroleum, which in the course of a dozen years has multiplied threefold. Notwithstanding the remarkable business activity of the past two years, the production of every other basic commodity has remained much closer to the 1913 level.

Even for pig iron and steel, well-recognized indicators of industrial activity, the index numbers for 1926 were only 127 and 156 respectively. Copper was 141, bituminous coal 121. Other commodities, such as cement, omitted from the chart to avoid confusion, showed the same tendencies and have in no case risen above 200, as compared with the 1913 production taken as 100.

Turning to activities for the twelve months ended November, 1926, electrical energy shows the usual seasonal swing, rising in midwinter, falling somewhat in midsummer, then rising with the approach of winter to a higher level than before. Crude petroleum, except for a sag in midwinter, rose steadily throughout the year, evidently in response to the demands of automobile traffic.

Copper production, closely related to the electrical manufacturing industry, although not necessarily keeping step month by month with copper consumption, rose fifteen points, from 131 to 146. The December, 1926, figure, not here charted, shows a drop to 140. Steel ingots, with a maximum of 178 in March, had fallen to 148 in November and dropped further to 138 in December.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

New England Industry Prosperous During 1926

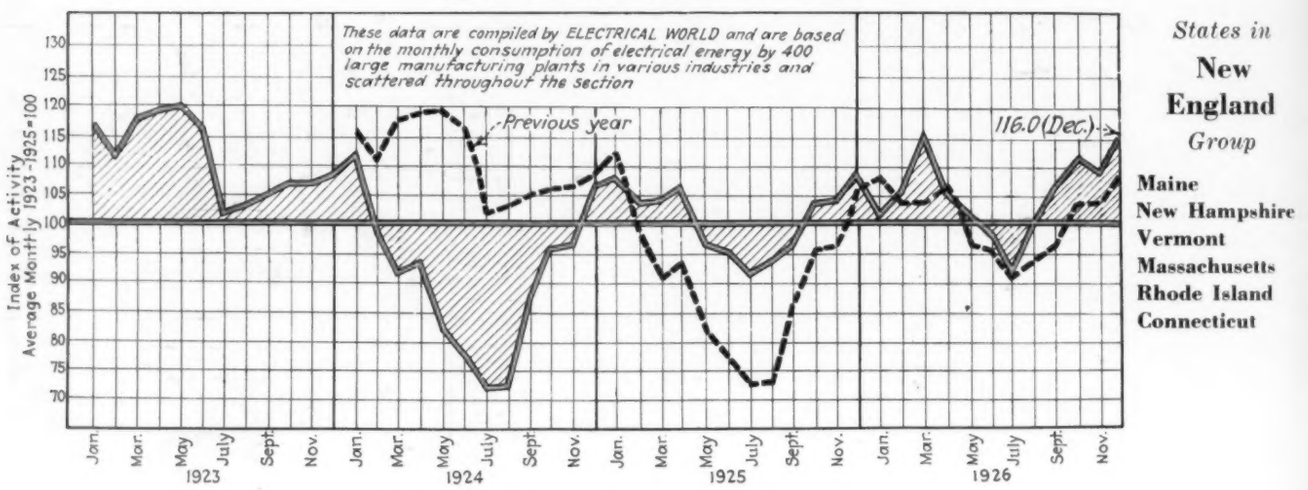
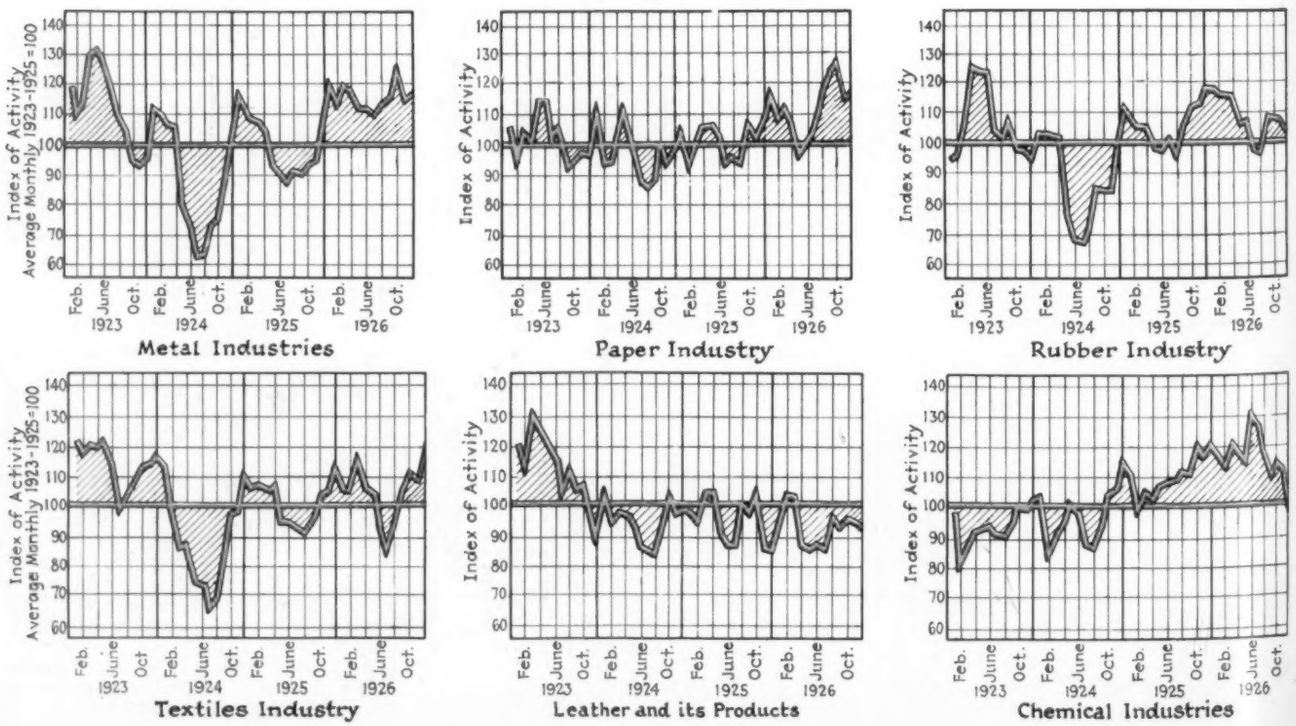
THE year just closed witnessed a prosperous condition in the manufacturing plants taken as a whole in the New England States. This condition was especially prevalent during the first quarter and last quarter of the year. The manufacturing plants of New England reached their peak of activities in March, then a recession set in, the low point being reached in July. August witnessed an abrupt upward turn, due largely to the low price of cotton and the subsequent upward trend in the operations of the textile mills. This upward turn was continued through October, November witnessing a slight decrease in operations, due largely to the small number of working days. December, however, witnessed another abrupt upward turn in the productive activities of the manufacturing plants of New England.

The opening of 1926 found the textile industry operating at a fair degree of activity, but this is largely normal in that industry for that season of the year. The textile industry reached its peak of activities in March; then a recession set in, the low point being reached in July. August witnessed an abrupt upward turn in the activities of the textile mills, and this increased activity continued through October. November witnessed a slight decline in operations, but December operations witnessed an abrupt upward turn, the year ending with the highest productive operations reported for any month since May, 1923. The paper industry was operating at a very high rate of activity throughout the year, reaching its peak of activities in October. At the opening of the year the rubber industry reported high productive operations. As the year unfolded, however, the productive operations of the rubber industry decreased, and it reached its low point in August. The last quarter of the year witnessed a slightly increased activity in the rubber industry. The leather-and-its-products industry was operating at a low rate of activity throughout the year; in fact, the productive activities of this industry have been at a low rate since the close of 1923. The metal industries, which include both ferrous and non-ferrous working plants, reported a very high rate of productive operations throughout the year.

Such is the picture of productive operations of manufacturing plants in New England, based upon the consumption of electrical energy by some 400 large manufacturing plants scattered throughout the section.

"Electrical World" Barometer of Industrial Activity in the New England States

(Data Unadjusted for Seasonal Variation)



General Industrial Activity in New England States